

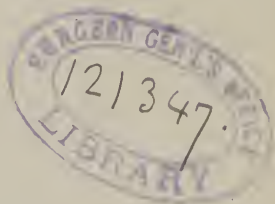
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ILLUSTRATIONS
OF
PHYSIOLOGY.

BY

C. D. RICE, M.D. ✓



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ILLUSTRATIONS OF PHYSIOLOGY.

INTRODUCTION.

1. THE term *Physiology* is derived from two Greek words, which, united, signify the science of life. In its widest sense, it is applied alike to animals and vegetables, but is more generally used in reference to man.

2. The study of this science has heretofore been mostly confined to members of the medical profession, and others only who possessed very general information on scientific subjects. But of late it is happily becoming a popular branch of education, and its importance as such is now generally acknowledged. "Every description of the human body which rivets our attention more steadily on its wonderful phenomena, and renders new to us what was before familiar, is beneficial, as unveiling the workmanship of God, and usefully affecting the mind."*

We have long been taught geography, because it gives us a description of the globe which we inhabit,

* Kinmont's Lectures.

and some of the laws by which it is ruled ; and we study, with peculiar interest, the description it gives of the particular state or province in which we reside. Is it not equally important to know something of the body we live in, and of the laws which govern its actions ?

3. Our study of physiology may derive increased interest from a connection with psychology, — the science of the soul or spiritual part of man. For, being created in the likeness of his Maker, he is, as it were, the prototype of all other forms ; standing pre-eminently at the head of the animal creation, in the symmetry and perfection of his form, the variety of his motions, and the orderly discharge of the many functions of life. He has justly been called a microcosm, or little world ; for a properly organized society, a well-regulated government, even heaven itself, has, like man, its head, its heart, and its various members.

4. As we are presumed to treat of the human system in a healthy state, we may premise that health is that condition of body and mind in which there is freedom from pain, and a pleasurable sensation attends the discharge of the functions of animal life ; the various organs and members acting in harmony, each adding to the sum of general happiness, each part seeking pleasure in the pleasure of the rest.

5. In the study of man, the eye should not rest satisfied with the material part. A far more interesting field of investigation lies within, — in the mind, or indwelling soul, which gives life and character to the outward form. Accustomed as we are to look upon

external things as the only real and substantial ones, we cherish our bodies as if they were of permanent existence ; but it is a fact well known to naturalists, that our bodies are constantly decaying and being renewed, so that we wear to-day but a small part of that material covering which we wore a year ago. It is cast off and replaced much like our garments ; the same identical body, in *all* its constituent particles, being never worn for two successive days.

6. The external form is not only a material covering, but also, as a machine, made use of by the mind, in its intercourse with the world. The easy manner in which it is capable of discharging its office, and the perfection with which the means are adapted to their numerous ends, declare it the work of a Divine Power ; while the perishable nature of its materials, and its constant tendency to decay, as plainly indicate its temporary duration.

“The use and end are the first things which manifest themselves ; for the end is in a manner the all in all in every stage of the progress, from first to last ; the very soul of the thing. Thus all things that belong to the body, and act as parts of the body, vividly represent and manifest the soul.” *

7. To trace the development of the organs and functions of the human system, and to observe in some degree the analogy and correspondence of the external part with the internal, — of the body with the soul, — will be the object of the following pages.

* Animal Kingdom, n. 32.

DIFFERENT CLASSES OF ANIMALS.

8. As we are obliged to rank man among animals, so far as regards his corporeal nature, it is necessary to say something respecting their different classes, at the head of which he stands. Some writers have considered it unwarrantable to call man an animal in any sense. This, however, seems an unnecessary degree of refinement; for, certainly, in several points man is as much an animal as other creatures which bear the name, and subject to the same laws in all that regards the body and its principal functions. Still it is only in the lowest plane that we so regard him.

9. By the arrangement of Cuvier, which is the most convenient which can be adopted at present, there are four groups that are intended to comprise every species: namely, the Vertebrate, Articulate, Molluscous, and Radiate. This last borders on the vegetable kingdom, and in a manner forms the connecting link between that and the animal: it constitutes a convenient starting point, from which we may gradually rise to the highest order of animal life, where man forms the connecting link between the natural and spiritual worlds.

RADIATA.

10. The radiate animals, as their name might imply, are generally of a circular form, with *radii* around a

centre, like the spokes of a wheel or the disc of a flower. Most of them have a mouth in the centre; and the stomach, which is situated just beneath or behind it, sometimes extends into the separate rays. The most perfect specimen of the radiate form is the starfish, sometimes called the five-fingers, which is very generally found on the sea-shore, at or near low-water mark.

Many individuals in this class possess but little more sensation than the generality of vegetables, and less motion and apparent sensitiveness than the sensitive plant. They all, however, have a stomach for containing and digesting the food necessary for their nourishment, which is not the case with any known plant. This circumstance of possessing a stomach serves very well as a distinctive character, by which we may separate the two kingdoms from each other.

11. They have several characteristics in common with vegetables, which other animals have not. They may be divided into several pieces, and each piece will, if placed in favorable circumstances, maintain an independent existence, and grow till all the parts of the original animal are fully developed. Some have been cut into twenty or thirty pieces, and thus twenty or thirty new animals have been formed from them; a trait which is daily met with in the vegetable kingdom, in the propagation of trees by slips and buds. Some, when lacerated in various ways, evince no pain, and show no indications of having a nervous system.

12. At the lowest extreme of this group, there are some varieties which are with difficulty placed either

among animals or vegetables, they are so much like both in some points, and so unlike both in others; and, in consequence of this difficulty, naturalists formerly disputed to which of the kingdoms the sponges and corallines belonged; nor are they all yet agreed as to the classification of the latter.

MOLLUSCA.

13. The term *mollusca* (from *mollis*, soft) includes those animals generally whose bodies are soft, like the slug or earthworm. But many of them have hard shells or envelopes, as is the case with the snail, oyster, and others, which afford them a protection from external violence, yet do not, strictly speaking, constitute part of the animal; but are, more properly, the habitations in which they dwell, and from which the occupant sometimes crawls forth, as the snail is seen to do. This class presents a great variety of form, dependent, in most cases, upon the development of the stomach. Their digestive organs are very complicated, and constitute their most prominent distinguishing features. Sometimes four-fifths of their whole structure is made up of the several parts of the digestive apparatus; as the stomachs, liver, salivary glands, and intestines.

14. They have a regularly formed heart, with one auricle and ventricle; and also an organ, having the office of lungs, to aërate and purify the blood. This last organ is not always for breathing air; for their respiration is generally, like that of fishes, performed by gills. Their power of locomotion is always quite

limited ; the snail and slug being about as good travelers as any of them, while many of the class never change their place any more than a plant.

15. Their temperature is about the same as that of the surrounding medium ; being but little above it in the cold part of the year, and but little below it when the weather is hot. Their blood is colorless, or, as it is commonly called, white. They seldom possess much symmetry ; so that, in most varieties, it would be difficult, and in some impossible, to divide them into two similar halves. They are, as it were, viscera, without a body ; living stomachs, whose principal office is to prepare food for a higher order of animals to make use of.

ARTICULATA.

16. Next in order is the articulated group. As a general thing, this class is totally different from the former, having free powers of motion, much symmetry of form, but a far inferior digestive apparatus. There is a full development of the muscular system, which constitutes a large portion of the body. They are commonly incased in a dense covering, which is made up of several pieces joined together by a strong membrane, and forming many distinct *articulations*, whence their generic name is derived.

17. In swiftness, some varieties of this sub-kingdom surpass all other animals ; as is the case with the winged insects. Their strength, too, in proportion to their size, is enormous. Many of them will fly

swiftly, while carrying a weight equal to that of their own bodies ; and the ant is often seen dragging to its hole a grain or dead insect two or three times heavier than itself, overcoming, in its passage, obstacles which would seem insurmountable by such a tiny creature.

Their habits are never changed materially, being almost wholly instinctive, and consequently not susceptible of improvement ; but they easily do, under the guidance of instinct, many things more perfectly than a higher order of beings would do by aid of good intellectual powers. This is admirably shown in the construction of the hornet's nest, whose exterior forms a complete protection from the rain and any sudden change of temperature ; while within we find, as it were, the apartments of a dwelling-house and the streets of a city. The cells of the bee are also proverbial for their greatest amount of room, with the least possible expenditure of material. But both these examples were the same, centuries ago, that they are now, — a masterpiece of architecture.

18. The two lateral halves of their bodies are equal ; by which means, they are well balanced, to enable them to fly with ease or jump with precision. They have a head placed at the anterior extremity of the body, and organs for catching their prey and chewing their food. Their hard envelopes, which serve them for a skeleton, are divided into segments, to which their muscles are attached.

VERTEBRATA.

19. The highest and most important class in the animal kingdom is that in which a vertebral column is found. It is to this class that man belongs, together with all the higher orders of animals.

To each group belongs certain prominent points, which serve to distinguish it from the rest. Thus the Radiata possess a mere vegetative existence, with but few properties peculiar to animal life. The Mollusca, a little more advanced, have more sensation, and are characterized by their fully developed digestive organs. The Articulata have great facility of motion, much muscular strength, and are noted for their predominant instinctive faculties. While the present class, or Vertebrate animals, combining much of the powers of all the preceding classes, is further endowed with a complicated nervous system, and more or less rational energy. This last quality is only fully possessed by man; but traces of it may be recognized in other animals. Thus in the horse, dog, fox, &c., we see many phenomena which can only be explained by allowing to them the faculties of remembering, comparing, judging, and thus adapting themselves to quite a variety of circumstances. Their ability to improve, by training or education, at once places their faculties above mere instinct, where any great degree of improvement would be out of the question; as is seen in the case of the bee, whose cells were as perfect hexagons in the days of the ancient Greeks and Romans as they

are at the present day ; and the little creature is impelled, by the instinct implanted by the Creator, to pursue the same undeviating course now as it did then, without interposing any reasoning powers of its own.

20. The structure of the vertebrata varies very much in the different orders which belong to the class ; but there is one prominent mark by which they are distinguished : this is the possession of a hollow column through which runs the nervous material which gives sensation to the body. This column is generally composed of short pieces of bone, called vertebræ, each having a hole passing through it near one side. These holes, when the vertebræ are placed in contact with each other, unite as it were, and thus form a continuous canal through which runs the spinal cord. These vertebræ can readily be seen by any one in the backbone of a lamb, fish, or any common animal.

At one end of the column there is an enlargement, consisting of several bony plates, concave on one side and convex on the other, which are so united as to form an enclosure, called the skull ; within which is a cavity for the lodgment of the brain. In the lowest of the class, this cavity is but little larger than the rest of the spinal canal, and in these the thinking powers are very limited ; but in man the skull is large, the brain fully developed, and his rational faculties so far in advance of those of other animals as to place him at once above them all.

21. In proportion as the brain and intellectual powers are developed and exercised, the instinctive

ones decrease; so that man, who is pre-eminent for his rational faculties, has far less instinct than other animals. Also, the more his mind is cultivated, and the farther he advances in acquired knowledge, the less he has of that which is merely instinctive; so that a child or a savage would be found superior, in the latter respect, to the more enlightened inhabitants of a city, or the learned professors of a college.

The vertebrate animals have red blood, but do not all breathe air; many belonging to the tribe of fishes. They never have more than four feet; while individuals of the preceding classes sometimes have an hundred. In some, as eels, serpents, &c., progression is effected simply by the motion of the spine, in which case the spine is very flexible, and so constructed as to allow of the greatest facility of motion; but not possessing great strength, which, in their case, would be quite unnecessary. This peculiarity may be seen in the backbone of a boiled fish, where a kind of cushion may be observed between the vertebræ, or pieces of bone comprising it. On the other hand, where great strength is required, as is the case with some other members of this class, the spine is firmly articulated together, and allows but little play among the constituent parts; the power of motion being delegated to the extremities, which are better adapted to that purpose.

In birds, great muscular strength is necessary to enable them to suspend their bodies, and wheel their flight through the light and yielding air. To give attachment to their muscles, a firm, unyielding skele-

ton is indispensable. The ample provision which is made for this, may be observed in the form of the back and breastbone of a fowl, where every facility is given for the attachment of muscles by which the wings are moved; and the bony frame-work is so united, that these muscles, though very powerful, can neither break it, nor even bend it to any injurious extent.

22. In man, locomotion is performed by the lower extremities; and, his progression being over the ground, which affords a firm support, he has no need of the flexible spine of the fish, nor of the consolidated frame of the bird; and he holds, in this respect, intermediate place between the two, — his spine being more flexible than that of the one, and not so much so as that of the other.

23. The motion of the jaws in this class is vertical, and no animals belonging to it have more than one pair; while, in the articulated class, many are furnished with two or three pairs, having a lateral action. The vertebrata are divided into several orders, each having certain points in which all of the order agree. The highest consists of the *Mammalia*, a term derived from *mamma*, the Latin word for the female breast.

MAMMALIA.

24. This order of animals (called also *viviparous*) is distinguished by having their young born alive, and sustained by nourishment drawn from the breast of the mother, for some length of time, before they be-

come capable of getting a living for themselves in any other way. Some of them have their young born in a comparatively vigorous state, able to walk about with some freedom, provided with a covering which protects them from the too severe influence of the air, and dependent on the parent for nourishment only; and even for this but for the space of a few months. This is the case with the colt, the calf, the lamb, &c. It will be found that this portion of the order never arrive at an advanced state of improvement; for it is generally true, that the ultimate perfection of any animal is in the ratio of its dependence upon the parent; that is, that those which are longest dependent finally become the most perfect, or have the greatest amount of intelligence (52). There are but few real exceptions to this rule, though there are more which would seem to be exceptions; for instance, the kangaroo, when first born, is about the length and size of the caterpillar, and is retained in a kind of sack, in which the teats of the animal are situated, where it is both carried and nourished till it is able to maintain a more independent existence. This may be considered an apparent, but not a real exception to the rule; for the length of time that the foetus of this animal is in the uterus is quite short, and its subsequent detention in the more external receptacle may very justly be regarded as a kind of secondary uterine life; this species thus forming one of the connecting links between the oviparous and viviparous orders.

The lamb is dependent upon its dam for support for only a few months, and reaches its highest state of

development in about a year. The colt, which is destined to attain a more advanced degree of improvement, passes a longer time in the foetal state, is dependent upon the dam for several more months (when not interfered with), and does not arrive at its highest state for seven or eight years. And the human infant, whose ultimate degree of psychical development is almost unlimited, is born in a very helpless state, is unable to walk for a year, cannot maintain an independent life for several more, does not attain full stature for about twenty, and does not arrive at the highest point of intellectual advancement for half a century.

25. The species of animals which in outward conformation most nearly resembles man is the chimpanzee. But, like the orang-outang and the race of monkeys, this animal has four hands, or, more properly speaking, graspers; for the hand, in the proper application of the term, only belongs to the human race; which race, in books of natural history, is placed in the distinct order *bimana*, or two-handed. The young chimpanzee closely resembles the human infant in the features of the face; for, before the full growth of the teeth, the mouth is nearly in a perpendicular line under the forehead, as it is in a child; but as it grows older, and the permanent teeth are formed, the jaws elongate, the mouth projects like that of other lower animals, and marks its brutal nature.

There is no other animal that has a foot precisely like that of man, and one so suited to sustain the whole structure in the erect posture. On a very superficial glance, that of the monkey tribe might seem

to ; but it possesses an opposable thumb, enabling the animal to grasp the limb of a tree with the posterior extremity as readily as with the anterior, but which serves in walking to throw the weight on the outer side of the foot (so called), and renders the gait awkward and tottering.

But, so far as the corporeal system is concerned, it is emphatically to the face and the hand that man owes his bodily superiority over other animals, when we take into account the varied expression of the one, and the power of adaptation of the other. Yet these would avail him but little in his intercourse with savage and more powerful animals, were it not for his superior intelligence ; but, under the guidance of his powerful intellect, his hands have constructed defences which render the assaults of all other animals harmless, and forged weapons of destruction, which no animal that walks the earth can resist or ultimately escape from.

THE HUMAN EMBRYO.

26. For our present purpose it is most convenient, in giving the natural history of man, to commence with the embryo ; and, having followed him through the successive stages of development to his arrival at adult age, to enter then more fully into the consideration of his structure and general functions.

27. In proceeding from the first point of his almost vegetative existence to the attainment of his full powers, man seems, as it were, to pass through the states of the lower forms of animal life. Thus, at first, he is a mere germ, — a small round zoöphyte, — without apparent life, sensation, or other quality which would distinguish him from the animalcules belonging to the lowest varieties of the radiata. In the next stage of development, he is an imperfect molluscous animal, without symmetry or motion, but with a digestive system large and well formed in proportion to his size; the liver and other glands being much larger in foetal than in after life. He then begins to resemble, in some respects, the articulata; having, like them, no apparent reasoning powers, but guided by instinct in what little he does. And it is not until sometime after birth that he manifests the mental superiority which characterizes the vertebrate class. But finally he ascends to a higher state of being than is accessible to any of the lower orders of animals.

28. The starting-point of the human embryo is a small vesicle, of a soft, gelatinous consistence, and about the tenth part of the size of a small mustard-seed. It is merely a small cell of a round form, enveloped in a thin membrane. In a short time, new cells of a similar form seem to spring up from this, and arrange themselves around it in a globular manner. It now has the appearance of that round, translucent, radiate animal, commonly known as the sunfish or sea anemone, found floating near the shore. No traces of organization, further than the generation of these

small cells, is to be found. The only evidence there is of its vitality is the same which is met with in vegetables, namely, that it *grows*.

29. The nourishment which supports this little zoöphyte, as it might be called, is furnished by the ovum or egg in which it is inclosed, as the chick in the egg of the hen. As it enlarges, the yelk of this egg is gradually converted into food for the growth of the small embryo, till even the membrane, called the yelk-bag, is gradually absorbed. In the lowest orders, this membrane becomes the permanent stomach; but, in the embryo of the vertebrate animals, it only serves a temporary purpose similar to a stomach, that is to contain food for the temporary support of the embryo.

The amount of yelk laid up in the yelk-bag for nourishment is very small, compared with that furnished for oviparous animals; for the time that elapses before the embryo is connected with the parent (by means of a membrane, called the chorion) is short, and consequently but little nourishment is necessary; while, in the case of the bird, a connection with the parent is never formed, and all the nutriment necessary for the full development of the young must be laid up in the egg. Even the lime which the shell consists of is necessarily provided for the formation of the bones, to which it eventually so largely contributes as materially to weaken its resistance to the protruding chick.

30. This little embryo is much like the small opaline spot in the surface of the yelk of the hen's egg, called the cicatricula, and from which the chick originates, but is larger in proportion to the whole size of

the ovum. The little mass, as it advances in growth, begins to assume a form somewhat more distinct than that of the round vesicle which it at first possessed. It now is much of the shape of an oyster just taken from the shell, being larger at one end, which ultimately becomes the head of the fœtus; while the smaller and more prolonged part gradually elongates into the body and extremities.

Along the median line, a tubular structure (which is permanent in the lower fishes, but only temporary in the higher animals) is then developed, called the dorsal cord. From this, as a germinating point, the spine is generated. From the spine, still in a very imperfect state, thin plates project laterally, and, meeting in front, form the envelope of the chest and abdomen. It is within this that the ribs are ultimately developed, together with the breastbone and clavicles.

31. While all this incipient formation is going on, the embryo has merely a vegetative life, simply absorbing the nutriment provided for it in the ovum. But, before greater progress can be made, the rudiment of a circulating system becomes necessary; and, for this end, the cells on and near the surface, lying in contact with each other, assume the form of very small tubes. These tubes, not larger than a very fine hair, gradually extend themselves, and form a delicate network of vessels, to convey the nourishment from the exterior to the more central parts. This network is to be seen in an egg which has been sat upon a day or two, and is said to be *bloodshot*.

32. A serous membrane also forms around the embryo, which, like other serous membranes, is a shut sack, like a pillow-tick or a bag sewed up at both ends. This is called the amnion, and by it a considerable quantity of fluid, like water, is secreted, in which the embryo is inclosed; as if this shut sack were folded in upon itself, and the embryo were contained between its folds; or as if you should thrust your fist against one end of a pillow, and thus shove it within itself — your fist would occupy the same situation, in the reduplication of the pillow, that the embryo does with regard to the amnion.

33. Near the upper part of the spine and in front of it, the heart is formed. This is of simple structure, like the permanent heart of the lower orders, being a canal, receiving the blood at one end and sending it forth at the other. It is destined to undergo two important changes before it reaches its ultimate admirable construction.

34. Almost simultaneously with the formation of the heart, a temporary and very rudimentary lung is provided for the aëration of the blood. This is called the *allantois*, and is like the permanent gills of the mollusea: but it is needed only a short time in the human embryo; and, when a more suitable provision is made for the changes to be effected in the blood, this shrivels up, and leaves only a trace of having ever existed.

35. An important change is soon to take place in the general mode of development of the embryo, which begins to assume more of the characteristics of a ver-

tebrate animal, and is, during the remainder of its uterine life, called a *fœtus*.

ANALOGY OF THE EMBRYO.

36. In all those operations of Divine Providence which are commonly called the works of nature, we can easily trace the finger of nature's God. Every thing which he has created possesses something of his image, either direct or perverted.

Man is created emphatically in the image and likeness of his Maker ; not only in a natural point of view, as regards his body, but also originally, when regarded spiritually, as to the soul and its complicated operations.

37. The elevation of the soul from the low and lifeless state, in which it is found at this day, to a vivified state, in which it becomes the recipient of all that is good and true, is called *re-generation*, — a process which would be to the spiritual, what generation is to the natural man. So, if the process of the formation of the body, from its first point to its ultimate birth, be rationally understood, it will help to illustrate the process of that *new* birth, by which the soul, from being, as it were, a lifeless substance, — “dead in trespasses and sin,” — becomes a receptacle of Divine Love and Wisdom, a living temple for the worship of God, and enjoyment of holiness.

38. The number and variety of thoughts and affections in the human mind, which serve to constitute the soul, are generally spoken of as quite limited ; but

the more we study into the nature and tendency of our moral feelings, and the various springs of action by which we are influenced, the more extensive shall we find the chain. And it is doubtless true, that, if we could extend our inquiries as far as the subject plainly admits of, we should find as extensive a range of thoughts, motives, sentiments, &c., entering into our spiritual part, as there are elementary fibres and tissues belonging to the natural body: also, these would present as many grades in their advancement from the most lifeless and confused to the most perfect, as there are grades in the animal kingdom; from the almost vegetative radiata to the complicate and matchless form of the highest of the vertebrate group.

39. In the words of pure Wisdom it is said, that “the kingdom of heaven is like a grain of mustard-seed, which is indeed the least of all seeds; but, when it is grown, it is the greatest among herbs.” This is illustrative of the origin of truth in the mind, and plainly points out the very small cell or seed, from which the soul starts in its spiritual growth; as the natural body originates in the very small cell (28) which is derived from the parent, and from which the various textures are in time developed. From the many passages of Scripture which relate to the rise and progress of truth and goodness in the mind; from the origin and growth of churches and societies, which are, as we may say, but men in a larger form; and from the innumerable examples of the creative Power, as exhibited in natural things,—we may not only infer that the birth and growth of the spiritual is in

perfect analogy with that of the natural man, but that the one must necessarily be a type of the other.

40. It is seen (29) that the incipient states of the embryo are, in a great degree, passive; that nourishment is provided by the parent for its sustenance; and it is merely a recipient of that which contributes to its own increase in size, and the proper arrangement of its organs. In an orderly course of regeneration, like circumstances are found. The mind being, as to spiritual matters, in a void state, almost passively receives the spiritual nourishment provided for it, and which may contribute to its organization. It has, at first, nothing of a well-arranged assemblage of parts, — nothing of the truly human form; but all is sensual, or nearly so, with little to distinguish it from that which is merely animal in its propensities.

41. In the period of tutelage, correspondent to the earlier stages of the embryo, and before any thing like regeneration takes place, the knowledges of that which is good and true are instilled by parents, teachers, and other providential means: and these, remaining stored up in the memory till needed, are called *remains*; which, like the nourishment in the ovum (29), are provided without the agency of the individual, to sustain the spiritual part or principle, in subsequent states of formation, without his manifesting a disposition to choose or reject that which is held out for his appropriation by his spiritual mother.

This readiness to appropriate to himself the instructions of his mother (the church) prevents that discrimination which would be used at a more ad-

vanced stage of religious life, but renders its possessor docile and easily led to imbibe what would be conducive to his well-being, if it be really good and properly offered. Any who have witnessed the conduct of those who are called "awakened" at the revivals of religion which occasionally prevail, will easily recollect the very passive and recipient state which they generally manifest, and how blindly they follow their leaders in their various religious opinions. Although these revivals afford but imperfect specimens of spiritual birth, they serve very well to illustrate this one point. But truths are sometimes held out to the young inquirer, so mingled with what is false, that, instead of aiding his normal growth, they would rather contribute to his deformity.

42. As, in the natural embryo, there are some organs which serve only a temporary purpose (34), so in the spiritual we find many motives and affections of the mind, which are useful in the formative state, but which cannot remain as the process of regeneration advances. Thus the fear of future punishment serves, in some cases, to awaken the soul to a sense of its dangerous and sinful condition, and may lead to the development of some interior affections subservient to spiritual growth, but can have no place at an advanced period of religious life. It is like the law, which, Paul says, "is a schoolmaster to bring us to Christ." There are several other mental affections — such, for example, as the love of approbation or of a good reputation — which have a tendency to correct the life of the unregenerate, and prepare for the reception of what

is more elevated; but which, after having, as it were, contributed the germinating point from which better feelings have originated, must wither up, so far as to give place to affections which may have a more permanent character.

43. The human soul cannot become regenerate in a moment. It has to pass through the lower states of spiritual life, before it can arrive at a higher (27); and its progress must be, in a greater or less degree, gradual. At first it is a spiritual zoöphyte, manifesting some evidence of being really alive, and that is all. Many individuals never advance beyond this condition; while others, continuing to imbibe wisdom and love from higher sources, attain a much more elevated degree. But, during the first or embryo state of regeneration, little of the truly angelic, to which the human form corresponds, is to be seen or reasonably looked for; and the more gradual, regular, and passive is the reception of charity and faith in its purity from the church, the more normal and healthy will the subsequent stages of religious development probably be.

THE FŒTUS.

44. At the third month of uterine existence, the fœtus will generally weigh an ounce and a half; the head is much larger than the rest of the body; the mouth is not yet open: but the fingers begin to separate

from each other to form the hand ; the legs are longer than the prolongation of the spine, which, in the embryo, extends, like the permanent tail of the lower animals.

The heart having already, since its first simple form, passed through quite a metamorphosis, lays aside its previous rudimentary shape, and is prepared for a more complicate circulation of the blood. Its form, in the outline, is precisely what it always retains, and is familiar to every one, being like that of the common quadruped. It consists of a thick, fleshy inverted cone, called the ventricles ; and of the double appendage over its base, of a thinner and more pliable texture, called the auricles, from their resemblance to the ear. The ventricles are separated from each other by a partition, which divides the more muscular part of the heart into two cavities.

The auricles are like two small bags or pouches, having a hole between them called the *foramen ovale*, which forms a communication from the one to the other. This hole has a valve attached to one side of it and partly covering it, which, after birth, closes the *foramen*, and thus permanently divides the cavities. The auricles are designed to receive the returning blood, and cause it to pass into the ventricles ; while the latter propel it through the system, as will soon (46) be more fully described.

45. The demands of the fœtus for nourishment to supply its now rapid increase in size, and manifest change in structure, calls for a more perfect connection with its parent. To effect this, the temporary viscus,

called the placenta, is formed. To give a familiar illustration of this peculiar substance, and its manner of growth: If a potato be left in a basket upon the ground, and exposed to the influence of warmth and moisture, it sends forth sprouts, which attach themselves to the inner surface of the basket, and spread a thousand little roots upon it, to absorb nourishment for its growth. This network of minute roots is to the potato what the placenta is to the fœtus; for a kind of cord, consisting of two arteries and a vein, passes out of the belly where the navel is afterwards seen, and, extending through the fluid which surrounds the fœtus, and from which at first it absorbed nourishment, fastens upon the membrane which lines the womb. Here it spreads itself, forming a multitude of small bloodvessels, which open their mouths upon this membrane, which is itself in a highly vascular state, and suck up the nutritive blood of the mother, which is, during pregnancy, brought to this part of her system in great abundance.

46. When the placenta is formed, and the heart becomes adapted to its more important office, the fœtal circulation is as follows: — The blood, which has been purified and enriched in the placenta, is conveyed by one of the vessels in the above-mentioned cord, called the umbilical vein, partly direct through the venous duct to the ascending *vena cava*; and it partly flows to this large vein, through the vessels leading to and from the liver; which viscus is proportionately larger in the fœtus than in after-life. Having thus been transmitted through the two great depurating organs,

the placenta and foetal liver, it is in the condition of arterial blood; but, being mixed in the vessels with that which has been returned from the trunk and lower extremities, it loses this character in some degree by the time that it arrives at the heart. In the right auricle, which it then enters, it would also be mixed with the venous blood, conveyed by the descending *cava*, were it not that a very curious provision exists, to prevent, in a great degree, any such further dilution. The Eustachian valve has been found to serve the purpose of directing the arterial blood which flows upwards from the ascending *cava*, through the *foramen ovale*, into the left auricle, whence it passes into the ventricle; whilst it also directs the venous blood that has been returned by the descending *cava*, into the right ventricle. When the ventricles contract, the arterial blood, which the left contains, is propelled into the *aorta*, and supplies the branches that proceed to the head and upper extremities, before it undergoes any admixture; whilst the venous blood, contained in the right ventricle, is forced through the pulmonary artery and arterial duct into the descending *aorta*, mingling with the arterial current which that vessel previously conveyed, and passing thus to the trunk and lower extremities.*

The head and upper half of the body, which at this period are quite in advance of the other parts in their development, require, and thus receive, the purest blood to sustain them and promote their completion. But the blood in the right ventricle, which is dark or

* Carpenter's Human Philosophy.

venous, as it passes through the pulmonary artery and the temporary short vessel called the arterial duct into the large descending aorta, divides; part going to nourish the lower extremities, and part going back to the placenta to be renewed by the maternal circulation.

47. The lungs of the fœtus, which are beginning to assume the perfect form which they ultimately attain, do not exert any influence upon the blood, as in after-life, but merely receive as much of the materials of growth from the circulation as is necessary for their development.

48. The liver is even now a purifying viscus, and the blood which passes through it is changed and improved by its agency; so that, though this fluid receives its nutritive qualities, and is rendered arterial in the maternal circulation, the imperfect fœtus contributes, by means of its fully developed liver, to fit it in some measure for the uses it is to perform in its own economy.

49. Between the fourth and fifth month of uterine life, the fœtus is endowed with the power of motion. This at first is a source of temporary distress to the mother; but after a few days she becomes accustomed to it, and in a great measure ceases to be troubled by it. This ability to move is evidence of the formation of the nervous and muscular systems, but does not indicate the existence of any thing more than an incipient state of animal life.

50. As the unborn child or fœtus has all its organs formed by the sixth month, the remaining portion of

the time spent by it in the womb is more or less necessary, and always expedient, in order that all parts may arrive at that degree of maturity which gives it a fair prospect of surviving the important changes which are before it. And though there may be exceptions to the rule, yet the viability, or power of living independently of its physical connection with the mother, is not to be depended upon before the full term of its uterine life is ended, or nearly so.

A short time before birth, the fœtus swallows some of the fluid in which it swims, and digests it. Much of this goes to nourish its body; while that which does not, remains in the intestines till it is born. This seems designed to prepare its stomach for an important office it has to fill in a subsequent mode of life.

ANALOGY OF THE FŒTUS.

51. Children and others within the pale of the church, whose minds have by previous culture been brought into a state of partial order, but who still are merely receivers of the knowledge and instruction imparted by their spiritual teachers, without possessing independent thoughts and feelings respecting religious things, may be said to be in a fœtal state. In them there is the greatest need of a source from which they may derive spiritual nourishment (45); and their mental powers are not sufficient to do much more than merely receive and store up in the several departments of the mind the nourishment which is necessary for the development of the regenerate state (46).

52. It is a general law of nature, that the longer and more dependent are the periods of uterine existence and helpless infancy, the greater will be the perfection ultimately attained (24); and this generally holds as true respecting the psychical part of human life. Our early states of dependence upon our spiritual guides serve to prepare us for a perpetual acknowledgment of our dependence upon a heavenly source of all that is ever good and true in us. This is important; for as our natural life is never wholly independent of others, so neither is that of which the natural is a type or outward manifestation.

53. It is some time before the novitiate in spiritual things has those organs of the mind fully developed (44), which he will need when he comes to look around him for spiritual sustenance. It is well for him that he does not yet wish "to wrest things hard to be understood;" and in the incipient state, analogous to foetal life, a very simple arrangement of the mental powers is better fitted than the more fully endowed organs of manhood.

The natural fœtus, nourished by blood received from the mother (46), and its heart, is very simple in its functions; but gradually grows more complex, according to its action upon this fluid. Its circulation is also adapted to its dependent situation. Now, blood is to the body what Divine Truth and the holy principle of Charity are to the soul. These correspond to the blood; and, in their various ultimate forms, they constitute all that is necessary to aid the spiritual growth of the young Christian. They are brought

forward and adapted to his state, as nearly as they can be, by the church, parents, or spiritual guardians, vivified by being brought into practice by them; and all he has to do is to admit these principles into, and distribute them through (46), the several departments of his spiritual body, and thus prepare for its growth. But, to effect this, there must be a bond of union with the Source of good, generally through the medium of members of the church, with whose good affections those of the recipient entwine themselves, and thence derive sustaining influences; like the fœtus, through its placental vessels (45), insculating with those of the maternal circulation.

54. In order that knowledges and affections may be perfectly assimilated, they must be received by love in the will, to which the heart corresponds (or, as we are accustomed to say, with a willing heart), and thence transmitted to every *tissue* of the soul. In its course, however, some portion will necessarily pass through a kind of interior purification, analogous to the action of the liver, to adapt it to the peculiar state of the growing mind; for this is necessarily different from that of the adult in religious life.

55. But, in the early stage, faith in the understanding, which corresponds to the lungs, is only in a formative state (47), and consequently has no direct agency in preparing truth for its own nutrition, any further than to receive and appropriate so much as may be necessary to the completion of its own development; though in after-life it exerts an all-important influence among the vital functions.

56. While the probationer remains perfectly quiescent, docile under the guidance of those he considers wiser and better than himself, manifesting no refractory movements of his own, little or no peculiar sensation of a painful nature is experienced by those who stand in the place of the spiritual mother. But this tractable or passive state cannot always continue ; and, some time previous to the development of the regenerate state, he who has hitherto been but a passive recipient of that which contributed to that development begins to manifest a determination to act of himself (49), and to show that he ultimately intends to do so, independently of any immediate agency, — of any earthly parent. This first fœtal motion is not unattended with some feelings of anxiety on the part of the spiritual parents, — some dread that evil consequences will result from this unborn freedom ; but a consciousness of their necessity, as a precursor to regeneration, soon dissipates most of the unpleasant feelings, they well knowing that no one can become truly regenerate through the labors of another, but that each must act of himself as much as an acknowledgment of the Divine Source of power will admit of.

57. A state wherein what is good and true is received in such a manner as to undergo a slight degree of moral digestion, is entered upon a short time before real new birth takes place. The individual imbibes the instructions which are held out to him, and the influences by which he is surrounded ; stores them up in his memory, investigates them by his rational powers, and, having reflected upon, or properly digested

them, appropriates what will most effectually contribute to his individual growth (50).

Finally, at the close of this preparatory state, the various affections of the mind will have become quite fully developed, and fitted to maintain an existence much more independent of mediate agents, and separated from tutelar guidance, than has hitherto been possible, without endangering the moral well-being of the subject, and perhaps extinguishing the spark of divine life, by which he might otherwise have soon become animated.

BIRTH AND GROWTH.

58. The term of foetal life having been completed, and all the organs of the body prepared to maintain an existence nearly independent of the mother, it becomes necessary, in the course of natural things, that the infant should be freed from its former connection with the parent. This separation, which is called birth, is not effected without pain and distress to both. The womb, stimulated by an inherent tendency, at the completion of the ninth month of gestation, contracts with great force upon its contents, and, aided by the simultaneous contraction of the surrounding muscles, gradually expels the infant, which is thereby introduced into a new state of life.

59. For a few moments, the connection with the

parent is maintained through the placenta, till the lungs of the infant become inflated with air, and the heart assumes its altered condition. The connection is then broken off by a division of the vessels heretofore uniting it with the mother, and the child is no longer dependent upon her for the aëration of its blood, which in future is effected by its own lungs.

60. The circulation of the blood is now changed. The foramen, or opening between the auricles, is closed by its valve; and they are in future as separate from each other as are the ventricles. And the heart, having now four cavities instead of three, maintains the true circulation of the mammalia; whereas it has heretofore carried on a circulation, such as is peculiar to reptiles and fishes. The blood, being exposed to the influence of the air in the minute cells of the lungs, parts with the carbon which it contained, and which in a measure rendered it dark-colored; and, in place of it, absorbs oxygen from the atmosphere, which renders it of a florid or scarlet hue. It then passes through the pulmonary vein into the left auricle, by the contraction of which it is forced into the left or corresponding ventricle. This ventricle, having thick, fleshy walls, and consequently great muscular strength, propels the arterial blood through the aorta, both into the upper and lower parts of the body; where it penetrates, by means of its minute vessels, every organ and tissue, and parts with its oxygen and whatever nutriment it contained. In return, it takes up the carbonaceous and refuse materials, wherever found, and is transmitted by the veins back to the right

auricle ; receiving, just before it enters it, a quantity of nutriment from the thoracic duct.

The blood, with its newly-acquired nourishment, now requires to be vivified by the influence of the atmosphere. To effect this, it enters the right auricle ; by the contraction of this, it is made to pass thence into the right ventricle, and is thrown, by the powerful contractions of its walls, through the pulmonary artery into the lungs, there to undergo the necessary change. This completes the *circle* through which the blood passes, and is therefore called the *circulation*.

61. Formerly, the mother almost wholly digested the food for the demands of the fœtus ; but now she only furnishes it in a very digestible state, called milk, which is secreted in her breasts ; and, being drawn thence by the infant's mouth, and mixed with saliva there, is swallowed into its stomach, where it undergoes an easy process of digestion, and assumes a new state fitted to promote its growth. Passing through certain changes yet to be stated (140), the nutritious fluid formed therefrom enters the thoracic duct, and is by this emptied into the large vein, which conveys the blood to the heart. But, as the milk does not entirely consist of pure nourishment, a portion of it must necessarily pass down with the effete or worn-out materials in the system, through the lower bowels, and thrown out of the body as useless.

62. More food is taken by the infant than is merely necessary to maintain its ordinary functions ; and the surplus, being assimilated, adds to the weight and

solidity of its body, and thus promotes its regular growth.

During the first year of infancy, the child is dependent on its mother, not only for care and protection, but further for the milk, which, being food nearly prepared for assimilation, forms the most suitable nourishment it can have, and that which is in nature designed for it. After this period, its organization seems to call for a different kind of sustenance. Its system is more robust, its tissues are more firm, and the increased demands for the materials of growth call for a larger supply of food than the mother, from her own secretion, can afford. The protrusion of its sharp little teeth also imply that a more solid kind of food is expected by the system; and, if these suggestions are not listened to, a gradual emaciation and general feebleness repeat the demands in language which cannot be misunderstood.

63. The child, now passing from the dependent state of infancy, selects from the food presented to it, that kind which is most agreeable to its taste, and generally best suited to its condition. This, if of a solid kind, it chews, and reduces, by aid of its teeth, to a pulpy consistence, and, by the act of swallowing, conveys to its stomach.

During several years, however, which are generally allotted to the period of childhood, the parents must provide the means of subsistence, and such clothing as the climate renders necessary to preserve the warmth of the body; and it is seldom the case in the temperate zones, that the child is able to provide

for its own maintenance before the age of twelve years, though some are unfortunately thrown upon their own resources at a much earlier period.

64. As the age advances to youth and manhood, the general firmness of the tissues is increased. The bones become less pliable, and contain more earthy matter, which imparts to the whole frame a degree of strength and power of resistance highly important in adult age, but which was not only uncalled for, but would even have been decidedly injurious, during the previous stages of life, when rapid and continual changes were taking place both in size and form, and the whole body was undergoing those alterations peculiar to the formative state.

ANALOGY OF BIRTH AND GROWTH.

65. That period of spiritual progress when (from being a mere recipient of goodness and truth, imbibed in a passive manner from those to whom we look for guidance) we voluntarily assume a religious life, inhale the vital air, is by far the most momentous of our lives. The period at which this change takes place is seldom before the age of early manhood, often later; and there are now so few healthy parents, in a moral point of view, that this change rarely takes place in a regular manner, if it does at all.

66. There is no reason referable to the Creator, why all, after arriving at years of discretion, should not voluntarily become regenerated, and enter upon that course which leads to a heavenly life. It is re-

lated by Swedenborg, that, in the first ages of the world, there were hardly any who did not, in obedience to Divine rules, receive goodness and truth into their souls, and become fitted for eternal happiness; and on visiting some families, in the spiritual world, of those who formerly belonged to the most ancient church on this earth, several generations would be found, from which none were missing; so regular had been the course of instruction and subsequent appropriation of what pertained to Divine life.

67. But now this change, corresponding to birth, seldom takes place without sickness, distress, or some kind of severe trials. As, since the first fall from holy life, woman, in a natural point of view, has brought forth in pain and sorrow; so has it necessarily been spiritually, and so it must continue to be as long as there is in mankind an inherent disrelish for that which is heavenly.

68. In most cases, after the removal from the special guidance of spiritual parents (59), when we begin to assume an independent existence, instead of admitting the vital air into our lungs, or, in other words, receiving faith into our understandings to vivify the truth in our will-principle, we close our perceptions (nostrils and air-vessels) to spiritual influx; and, immersing ourselves in sensual pleasures, a death of all our moral life ensues. But this is the reverse of regeneration as illustrated by natural birth, which it is the object of this section to treat of.

69. Instructions are given by spiritual guardians, and every effort made to fit the recipient for subse-

quent goodness and happiness. But, as the human constitution requires that each individual should live as if he acted of himself in all respects (though in the constant acknowledgment that all power to do so is from above), it becomes necessary that he should choose or reject a religious life in perfect freedom. Having, in the full exercise of this freedom, received into the spiritual system that which is good and true, he is prepared to love it, and allow it to become part of himself; and he has no more disposition to reject it afterwards, than he would natural food after it has once entered his organization, and become part of his natural body.

70. The case is quite the reverse with respect to good resolves, formed, as they generally are, in trouble or under the influence of fear; as they are commonly disregarded as soon as the troubles cease, or the fears subside. Also any virtue practised from a regard to public opinion, or for the sake of a good reputation, not originating in the life's love, is as transient as are the external circumstances which induced it, — as artificial respiration seldom resuscitates a still-born child. Still the outward practice of virtue is very desirable, as it often prepares the way for its inward reception; for instances are not wanting, where the lungs, having been inflated by air artificially introduced, *voluntarily* inhale it after the removal of these means. And still more important is early religious instruction, in fitting the individual for a life of real piety; as the body of the fœtus, while passively receiving nourishment prepared without its agency by the mother,

· becomes thereby adapted to breathe the vital air, and receive and digest food, to enable it to maintain a separate existence. This stage of early instruction should be long enough to implant the seeds of goodness, and allow them to repose as in a genial soil; for if the spiritual infant be exposed to an atmosphere never wholly pure, before the preparatory state is sufficiently advanced, death or a puny existence will ensue, like the ordinary consequences of a premature birth.

71. Having once passed that critical period when a good life is voluntarily assumed, the viability of the subject is increased, and the church (spiritual mother) rejoices that a child is born into the world. But numerous dangers still beset his path, and the unceasing care and maternal tenderness of the church is indispensable to his growth in grace.

72. As the child is naturally dependent on his parents for food and clothing, after he has ceased to be nourished exclusively by the milk of the mother; so, in a spiritual light, he is dependent on his spiritual guides for that to which food and raiment correspond; namely, for the knowledges of what is good and true, which constitute the best food for the soul, and that outward culture and decorum, which, as a garment, is a suitable vestment for the mind.

In the other world, an individual will be known immediately by the garments in which he is clad; that is, by the external appearance; and it should be so here. But, from the general dissimulation which prevails, many go in sheep's clothing who inwardly

are ravening wolves ; the face seldom revealing the thoughts which pass within the mind.

73. In our daily walks, we are all in the habit of seeing two prominent classes of children, between whom a marked difference exists. The food and clothing of the first class is provided by the father's exertions, and nicely arranged by the mother's care ; while they repay those labors of love by subjection to parental control, rendering a willing obedience to their salutary commands. The order of things which here prevails is manifestly of heavenly origin. But it is painful to witness the state of the other class, who, at the age of from six to twelve years, roam lawlessly about in a ragged and hungry state, under the fostering care of no one, rendering obedience to no one, and exhibiting all the demoralizing effects of a premature manhood.

74. A little observation and reflection will show us the counterpart of this state of things. For in one part of the community we see all progressing in social order, under the influence of a chastened veneration for what is holy ; while in another we see that lawlessness which arises from want of religious bonds and instruction ripening into open and wide-spreading infidelity. But let the good of obedience be implanted in early life, let virtue be cherished and social duties enjoined during the periods of childhood and youth, and they will be likely to "grow with the growth and strengthen with the strength," and a healthy state of manhood ensue, suited to the duties and enjoyments of that period of life. Then, in a psychical point of

view, the bony framework will have acquired that power of resistance, and the tissues of the mind will have assumed that firmness, which prepare the internal man to withstand and overcome, by Divine aid, the various influences which may beset him, and to do for another generation what a former one has done for him.

GENERAL OUTLINE OF MAN.

75. Man is characterized by his erect posture; the relatively large size of his head; the possession of two hands, designed for almost any use, except that of the special senses and walking; the great length and size of the lower extremities; and the feet, adapted to support and carry the body, and not designed to do much else.

These may justly be considered distinctive marks; for though there are other animals which possess some of the individual faculties here enumerated, yet there are points of decided difference between them; as, for example, the ape, which can walk erect with some difficulty, but not with much firmness, and the member which serves him in the capacity of a foot can also be used as a hand.

76. That man was designed to walk erect, and in no oblique or horizontal manner, is evident from several circumstances. The head is articulated upon the neck by condyles, which, being placed horizontally,

cause it easily to be supported upon them in a vertical position, but would render any other kind than this extremely inconvenient and very fatiguing. No more awkward animal could be found than a man walking upon all-fours like a common quadruped: for his hips would necessarily be raised considerably higher than his shoulders; his legs and feet, having little to do with progression, or with the support of the body, would swing about in a most ungainly manner; while the weight of the body would be thrown forward upon the arms and hands, which, by their weakness and extreme pliability, show that they were evidently intended for some less servile occupation. The tiring effort, too, which in this posture would constantly be necessary to enable him to look forwards, upwards, or in any other direction than towards the ground, would still further show that the head was never made to be so supported.

77. While it is thus evident from his very construction, that man is intended to walk and stand erect, it is quite plain from their *diverse* formation, that all other mammals would naturally assume a posture more or less oblique, and in most cases entirely horizontal. Not but that the orang-outang and most monkeys do at times sit or walk erect; still their ordinary mode of progression, and manner of remaining at rest, is with the head leaning far forwards in advance of the rest of the body, which is often partly supported by the anterior extremities.

78. The head is situated at the upper extremity of the body, and, by means of its ovoidal shape and the

position of its condyles, is made nearly to balance upon the highest bone of the neck or spine, a slight preponderance being given to the anterior part; so that, if the muscles become quite relaxed (as is the case in sleep or death), the chin drops forward upon the breast. But the difference in the weight of the forehead and occipital portion is so little, that the muscular effort to maintain the balance is rather diminished than increased by it.

For the convenience of examination, the head may be divided into two portions, — the cranium and the face.

79. The cranium or skull is somewhat of the shape of an egg, the larger end of which is behind, but varying according to the peculiarities of the individual or of the race to which he belongs, and not perfectly alike in any two different persons. This part contains the brain, a large convoluted gland, through which the thinking powers, the propensities, and the affections, are exerted on the rest of the system, and thence on external objects.

The brain is divided vertically, in its median line, into two symmetrical or nearly symmetrical halves, called its hemispheres; and transversely into two distinct portions, called the cerebrum or brain proper, and the cerebellum or little brain. This latter, which is not so disproportionately large in man, is situated in a partial cavity in the posterior portion of the base of the skull; while the cerebrum occupies the remaining parts of the cranial space.

80. The anterior section of the brain is the medium

of the intellectual faculties, or that part through which ideas descend from some source above us into the mind, and may then be brought out into action by the various parts of the body, which serve as its instruments. By the examination of this part, the variety and extent of the intellectual powers of an individual or a race of men may generally be determined with some degree of precision. And by the proper culture of the thinking powers, through several successive generations, this part of the brain will become larger and more fully developed, and the skull will project forwards, laterally, and upwards, further than it otherwise would.

81. The vertex or highest portion of the brain is the medium or organ of the nobler sentiments of reverence, faith, benevolence, and perseverance. And, to give room for their ample development, a well-formed head should be gradually rounded over from the forehead to the back part, presenting the highest prominence directly over the ear, and gently sloping off in other directions.

82. The hinder portion of the brain, as well as the cerebellum which occupies the lower section of the cavity of the skull, are appropriated principally by the propensities, and to the domestic and sensual affections, such as love of home, of friends, of children, and of the sex.

“Every man that is born has a disposition to all sorts of evil, which must be checked by education, and, as far as possible, rooted out. This, first to be corrected by correction and punishment; then, by good

society and example, which lead to imitation ; and, at last, good is secured upon a true and reasonable religious basis. When these conditions are all observed, it is indicated by *the beautiful skull of the individual*. On the contrary, should the education be neglected, or no sudden misfortune nor operation hinder the first outbreakings of evil or disorder, the evil afterwards becomes habit, and produces peculiar wishes, both in design and practice, *which cause the formation of a badly shaped skull* in such cases. The peculiar distinctions of man, will and understanding, have their seats in the brain, which is excited by the fleeting desires of the will and the ideas of the intellect. Near the various spots where these irritations produce their effects, this or that part of the brain is called into a greater or less degree of activity, and forms along with itself corresponding parts of the skull." *

83. The brain cannot properly be considered as the origin of thought, or as the fountain-head from which ideas flow ; for, by a strict attention to the mental powers in ourselves, we may see that we cannot by any means originate a new thought ; but the most we can do is to bring our faculties into a suitable state of attention to any subject, and we shall then find that the thought flows into our mind from some higher source. By several experiments of this kind, an unprejudiced mind will soon be made sensible that it is from our connection with spirits that we are capable of receiving new ideas. It will also be evident from the well-known fact of frequent occurrence, that ideas

* Swedenborg : quoted in Goyder's *Epitome of Phrenology*.

come unsought into the mind, and not unfrequently when they are unwelcome guests.

84. The phenomena of merely animal life may be exhibited independently of the brain. For infants born without a brain will swallow food put into their mouths, breathe regularly, move their limbs, and often draw the milk from the mother's breast, and sometimes live for several days. Experiments, too, have been made upon some of the lower animals, by removing the brain, which have shown that life may be maintained for weeks, or even months, without its agency. But no instance is on record where the intellectual or sentimental faculties were exerted when the brain was deficient, and even a slight derangement of its organization will often prevent the regular exercise of the mental powers.

85. The face is dependent in some degree for its form, and in a greater degree for its expression, upon the peculiar development of the brain. In persons of a frank, ingenuous disposition, it is quite an index of what is passing in the mind; but, where any one has been in the habit of dissimulating, this is not the case to any great extent. In the ordinary transactions of life, this power of concealing the emotions, or of preventing them from being manifested by the expression of the countenance, is considered by worldly-minded men a valuable acquirement, enabling the possessor to manifest an appearance of friendship, where inward hatred exists, and to appear open-hearted and honest when designing to deceive and defraud.

86. In man, the mouth is neither large nor prominent, as it is in the lower animals. It is incapable of seizing food, which, on the contrary, is intended to be conveyed to it by the hand. The lips are well adapted to each other, and retain the food within the cavity of the mouth while the teeth are chewing it. They also, by their varied motions, modulate the sound of the voice, and, when necessary, divide it into words. The teeth are placed almost vertically, and, being generally even, present an arrangement quite different from that of any animal now known to exist; as all others have their teeth more or less oblique or interrupted, and generally quite prominent.

87. The nose is neither so large nor so well developed as in many of the lower animals; and the sense of smelling, simply, is far less acute. But much of the relative smallness in the size of the mouth, and diminution in the power of smelling, is owing to the artificial or civilized condition of most nations; and, where men live in a comparatively savage state, the merely animal senses are proportionately predominant. This may be seen in our Indian; where the nostrils are broad, the nasal cavities extensive, the mouth large, and the under jaw stronger and provided with more powerful muscles than it is among the whites.

In many of the lower animals, the nose is of chief importance in directing them in search of food, and in others it serves to give warning of approaching enemies. But it probably is but little serviceable to man for similar uses, even in the most barbarous state in which he has ever yet been found.

88. The ear in man is immovable, but so situated as to enable him to distinguish sounds with a good degree of accuracy, in every direction from which they may proceed. It is susceptible of a vast amount of improvement by culture ; for though the hearing may be more acute or quick in the savage state, yet the variety of its perceptions, and the pleasure to be derived from their cultivation, are far greater in the civilized.

89. The upper extremity, consisting of the shoulder, arm, fore-arm, and hand, bears some resemblance to that of the monkey tribe. But, the chest being broader, the shoulder has more lateral projection, carrying out the arm farther from the body, and thus affording it a greater degree of freedom of action. The arm is not so long as it is in that class of animals ; for the hand (25) of the orang-outang and the apes descends to the ankles, and even in the chimpanzee it descends below the knee, but no lower in man than about the middle of the thigh. Though they can move the arm as conveniently in some directions, and with as much relative force, yet they are more limited as to the variety of its movements.

90. The human hand is the most astonishing piece of mechanism, so to speak, that it is possible to conceive of. The corresponding member in the monkey race, with its weak and inefficient thumb, its inordinately long, slender fingers, though admirably adapted for *their* use for it, in grasping the small branches of trees and seizing objects of a particular size, is as far inferior to it, in the extent and perfection of its capabilities, as it is in advance of the paw of the cat.

Many other animals have members adapted more completely to a few definite uses than the hand of man would be ; as the claw of the sloth, for climbing up the trunk of a tree, and sustaining the weight of the animal, by being attached like a sharp hook to the rough bark, or around a small limb, — the claws of the tiger, for seizing and holding his prey, — the hard, sharp hoofs of the chamois, for leaping with safety and ease from rock to rock ; but the hand is not only an instrument or weapon itself, but the fabricator of every thing of the kind, which the want or convenience of man may demand.

91. The pelvis in man is broad, separating the hips considerably further from each other than is the case with other animals, to give a broad basis of support for the body ; and horizontal, suited to his erect posture. But, in the semi-erect apes, it is quite oblique, to be adapted to their inclined position, and in most quadrupeds it is vertical ; thus maintaining its uniform position, in relation to the whole body, being in all cases nearly at right angles with the spinal axis.

The muscles about the pelvis, as well as those upon the thigh and leg, are fully developed, giving that symmetry, roundness, and just proportion, formerly so much studied and admired by the Grecian statuary.

92. The thigh-bone does not descend perpendicularly from the hip, which would render the gait awkward and swinging ; but, as it proceeds downwards, approaches its mate, so that at the knee the limb is immediately under the weight to be supported ; while the inner condyle is longer than the outer, to compen-

sate for this obliquity, and adapt it to the head of the tibia (or large bone of the leg), which is surmounted by a horizontal surface, nearly flat.

93. The foot is in the form of an arch, resting upon the heel and the ball of the foot near the toes ; but, when the body is raised by the elevation of the heel, it rests upon a smaller arch, formed by the ball and the extremities of the toes. The large muscles which form the calf of the leg are attached to the toes and different parts of the foot, giving great command over that member, and enabling man alone, of all the mammalia, to stand upon one leg.

94. By nature, few animals, comparatively, are so ill supplied with the means of making aggressions upon others, or have so few of the means of self-defence, as man. But the superior adroitness of his hand, when guided by the still greater intelligence of his mind, have enabled him to surpass them all, in both these respects. “ Who would think, that in that naked biped, wandering melancholy and forlorn amid the woods, apparently the neglected outcast of nature, there were yet concealed such capabilities of divine excellence ? With his reason and hand, he stands disengaged from all the exclusiveness and speciality peculiar to the instinctive animals ; and none can tell those natural arts which he has to put forth, until he has made an essay of his powers, and opportunity or necessity either invites or urges him to call into being those devices and inventions, of which the germs and aptitudes have lain treasured up within him.” *

* Kinmont's Lectures.

95. His superior intelligence renders it probable, that eventually, when his mental powers are more fully developed, and his moral qualities bear a corresponding degree of advancement, man will be the only inhabitant on earth, excepting such animals as are conducive to the happiness or convenience of the human race. Hundreds of varieties have already become extinct, and their remains are found in a fossil state; while new species, suited to his varying wants, are daily springing into existence.

ANALOGY OF THE GENERAL OUTLINE OF MAN.

96. The outward form of man, though bearing the impress of divine workmanship, — with the high forehead; the expressive eye; the varying, but generally beautiful countenance; the broad chest or swelling bosom; the arm and hand, with their graceful movements; the commanding attitude, noble and erect; and the firmly planted foot, so well adapted to sustain the whole, — is, after all, if merely considered alone, but a perishable, material fabric, hardly finished in its structure before it begins to decay; and, if this constituted all that there is of man, it would hardly be worth the trouble for any one to write his history. But the convictions of the virtuous, and suffrages of the most enlightened, in all ages, join in the assertion, that he possesses an immortal soul; and to us the revealed knowledge of his spiritual existence gives to the study of his whole being an engrossing interest.

97. The soul, though invisible to our natural sight,

inhabits every part of the body, animating every fibre, however minute ; and it is to this alone that the latter is indebted for all that distinguishes it from a lifeless mass. For many ages it has been a question among scholastic men, whether the soul could have an existence separate from and independent of the natural body ; and many divines have taught, that it wandered about in the state of a subtle vapor, till, at the general resurrection, it should be again united to its former habitation. But this idea, founded in neither scripture, reason, nor common sense, is now becoming abandoned by the most able minds in all denominations ; and it will probably not be long before the scriptural doctrine on this point will be generally received as the true one.

98. In common works on Physiology, the soul has little or no attention paid to it ; and, in the past and present sensuous state of human knowledge, this has been best ; but the time will come when psychology, or the physiology of the soul, will be as generally taught, and nearly as well understood, as the physiology of the body is now, and doubtless will shed its rays upon the page of the latter, and illuminate many passages which have hitherto been illegible to our imperfect vision.

Though the soul is not to be discerned by the same process that brings natural objects to light, yet there are certain common evidences of its existence which are quite conclusive. Many other things are allowed by all to exist, although they are never visible, nor to be appreciated by the laws of matter in any form.

Such, for example, is the case with an inward pain : we can neither weigh, measure, touch, smell, taste, see, nor hear it. Still any one who has once felt a severe pain will not doubt its existence. Precisely so with the soul : though not subject to the laws of material bodies, its being will not be called in question by those that have *felt* that there is a soul within them.

The eyes have sometimes been spoken of as the windows of the mind, as the mental operations can be plainly traced by a peculiar kind of expression, which seems to speak through them, without varying their form in any palpable manner ; but the involuntary motions of the hand, and still more truly the muscles of the face, sometimes betray the presence of the inner man in their almost imperceptible fibrils.

99. The following, from the pen of Professor Alison, of Edinburgh, will serve in a measure to illustrate this point : —

“ It is a curious fact that the changes thus produced in one individual are *instinctively interpreted* by others. It is plain that the effects of sensation and emotion on the countenance, on the respiratory muscles, on the attitudes and gestures, are no sooner seen than they convey to the spectator a notion of the mental state of the person expressing them ; and several reasons may be given for thinking that the interpretation is not the result of experience.

“ These signs of mental affections are evidently very early understood by young children, sooner than any fixed associations can be supposed to have been

formed by experience of their connection with any particular modes of conduct.

“The natural signs of strongly felt emotions or sensations affect us more quickly and more powerfully than the expression of them by words or other artificial signs does; which would not have been the case, if both modes of expression had owed their significance only to experience, and therefore been on the same footing.

“To one who attends to them minutely, the varying expressions of countenance, manner, and voice, in a person of strong, unaffected feelings, convey *more meaning*, and denote nicer varieties of those feelings, than we have words to express, or than experience can have taught.” *

100. Though the indwelling spirit so completely fills its material tenement as even to shine through its very substance, yet it may leave it for a short time, and return into it again. This is partially the case in sleep, where the mind is less intimately connected with the body, and wanders without reference to time or space. But instances are on record, where the connection was completely broken, and afterwards re-established. One is related in Kings, xvii. 21, 22: “And he stretched himself upon the child three times, and cried unto the Lord, and said, O Lord my God, I pray thee, let this child’s soul come into him again. And the Lord heard the voice of Elijah; and the soul of the child came into him again, and he revived.”

The case of William Tennent, related many years ago in some of the most prominent religious journals,

* Alison’s Outlines of Physiology.

is quite well authenticated, and goes to illustrate this fact; while the repeated departure of the spirit of Swedenborg to the world of spirits, and its subsequent returns to the natural body, are too well known to need a comment. With respect to the former, it may not be out of place to make a more circumstantial notice.

The Rev. W. Tennent was settled over a parish in New Jersey above a century ago, and maintained the character of an exemplary minister of the gospel, during the greater part of a long life. At the close of his preparatory studies for the ministry, his health became affected by mental exertion and the peculiar state of his mind; the following account of which is from the *Massachusetts Missionary Magazine* for 1806:—

“His intense application affected his health, and brought on a pain in his breast and a slight hectic. He soon became emaciated, and was like a living skeleton. His life was now threatened. He was attended by a young physician, who was attached to him by the strictest and warmest friendship. He grew worse and worse, till little hope of his life was left. In this situation his spirits failed him, and he began to entertain doubts of his final happiness. He was conversing one morning with his brother on the state of the soul, when he fainted and died away. After the usual time, he was laid out on a board, according to the common practice of the country; and those in the neighborhood were invited to attend his funeral on the next day. In the evening, his friend and physician returned from a ride into the country, and was afflicted exceedingly

at the news of his death. He could not be persuaded that it was certain; and, on being told that one of the persons who had assisted in laying out the body thought that he had observed a little tremor of the flesh under the arm, although the body was cold and stiff, he endeavored to ascertain the fact. He first put his own hand into warm water to make it as sensible as possible, and then felt under the arm and at the heart, and affirmed that he felt an unusual warmth, though no one else could. He had the body removed to a warm bed, and insisted that the people who had been invited to the funeral should be requested not to attend. To this the brother objected as absurd; the eyes being sunk, the lips discolored, and the whole body cold and stiff. However, the doctor finally prevailed, and all probable means were used to discover symptoms of returning life. But the third day arrived, and no hopes were entertained of success but by the doctor, who never left him night nor day. The people were again invited, and assembled to attend the funeral. The doctor still objected, and at last confined his request for delay to an hour, and finally to a quarter of an hour. He had discovered that the tongue was much swollen, and threatened to crack. He was endeavoring to moisten it by some emollient ointment put upon it with a feather, when the brother came in at about the expiration of the latter period, and, mistaking what the doctor was doing for an attempt to feed him, manifested some resentment, and in a spirited tone, said, "It is shameful to be feeding a lifeless corpse;" and insisted with earnestness,

that the funeral should immediately proceed. At this critical and important moment, the body, to the great alarm and astonishment of all present, opened its eyes, gave a groan, and sank again into apparent death. This put an end to all thoughts of burying him, and every effort was again employed in hopes of bringing about a speedy resuscitation. In about an hour, the eyes again opened, a heavy groan proceeded from the body, and again all appearance of animation vanished. In another hour, life seemed to return with more power, and a complete revival took place."

It is said that Mr. Tennent was reluctant to give any account of what were his sensations and what he had seen during the time when his spirit had been separated from the body; but, yielding to the entreaties and persuasions of a friend who was deeply interested in a future life, he gave a partial narration of what had occurred to him, of which the following is an extract: —

"While I was conversing with my brother on the state of my soul, and of the fears I had entertained of my future welfare, I found myself in an instant in another state of existence, under the direction of a superior being, who directed me to follow him. I was accordingly wafted along, I know not how, till I beheld, at a distance, an ineffable glory, the impression of which on my mind it is impossible to communicate to mortal man. I immediately reflected on the happy change, and thought, Well, blessed be God! I am safe at last, notwithstanding all my fears. I saw an innumerable host of happy beings, surrounding the

inexpressible glory in acts of adoration and joyous worship. . . . I then felt joy unutterable and full of glory. I then applied to my conductor, and asked leave to join the happy throng; on which he tapped me on the shoulder, and said, 'You must return to the earth.' This seemed like a sword through my heart. That instant I recollect to have seen my brother standing before me, disputing with the doctor. The three days during which I had appeared lifeless seemed to me not more than ten or twenty minutes. The idea of returning to this world of sorrow and trouble gave me such a shock that I fainted repeatedly. Such was the effect on my mind of what I had seen and heard, that, if it be possible for a human being to live entirely above the world, and the things of it, for some time afterwards, I was that person. The ravishing sounds of the songs and hallelujahs that I heard, and the very words that were uttered, were not out of my ears, when awake, for more than three years. All the kingdoms of the earth were in my sight as nothing and vanity; and so great were my ideas of heavenly glory, that every thing which did not, in some measure, relate to it, could command but little of my attention."

101. It was said (75), that man is characterized, among other peculiarities, by the erect attitude. If this be true, as it certainly is, of the material form, it must be so still more emphatically of the immaterial or spiritual one. When he allows the designs of his Maker to be fully carried out, all parts of the mind will be under the guidance of that to which the head

corresponds ; which is the understanding of truth and the will of good, or intelligence and goodness. These holy principles should uniformly be placed in the highest department of the mind, should control the operations of the various propensities, and keep every feeling and motive of action in a subordinate place. We see all the lower animals constructed differently ; some assuming the oblique, and others the horizontal position. This is right with them. They are governed by their sensual appetites and corporeal instincts ; and such government fulfils the object of their existence. They are fitted only for an earthly life ; to gain their subsistence for a time, to propagate their species, then to die, decay, and give place to their progeny. Being under no moral government, they know no higher law than necessity and their natural choice. By these they are governed ; and, in being so, they answer their designed end, — fulfil the comparatively low object of their creation.

But, to an earthly existence, the human race has a spiritual one superadded, to prepare for which is the chief end of their natural being ; and the most prominent feature in this preparation is the reducing the various appetites, passions, and emotions, into orderly subjection to truth and good ; in other words, the bringing the soul or inner man into correspondence with that outward form, which is made in the image and likeness of God.

102. Those who allow the lower or animal propensities to predominate are *morally* in the condition in which a man walking upon all-fours naturally would

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be (76). But, in descending in this respect to the level of the brute creation, he would be very likely to go further, and have the body raised even higher than the head, and be more immersed in sensual things than brutes are capable of.

In the early part of the French Revolution, when the evil passions of man broke forth free from the restraints of religion or civil law, deeds of blood-thirsty cruelty were exhibited which have had no parallel among beasts of prey. The provident ant and hoarding squirrel lay up only enough for anticipated wants; while the miser feels poor, though the possessor of thousands, and will rob himself of the comforts of life to increase a store which is already too large. The salacious goat only gratifies his periodical appetite; but all the wives of Solomon are not enough to gratify the lusts of man, when allowed to wander unrestrained.

While men are in this morally *horizontal* state (76), they will find it very tiresome to look upwards, — to things of a heavenly nature, or even forwards, — towards the future. The experience of any one will suggest to him how true this is; for, while we allow the love of the world, its wealth and its pleasures, to be on a par with religious and moral feelings, or, what is more frequently the case, to engross a greater share of attention, the attempt to elevate the thoughts and affections is tiresome; we are unwilling to think of the future, and our whole field of spiritual vision is the small spot of earth upon which we are walking, — the fleeting pleasures of the

moment, the gratification of our appetites and passions.

103. In looking at a well-shaped head, we find the highest point to be that which phrenologists allot to the organ of veneration or reverence. Now, where the moral faculties are arranged as they ought to be, the veneration man feels for the Deity should occupy the highest place in the soul. In the reverence we feel for those among us whom we regard as our superiors, there is ever something to detract from the sentiment which is entertained towards them. But the devoted feeling within us towards the Author of our being may be indulged without limit, and admitted without qualification. It takes away much of the creature-worship which too often exists; and it makes man regard as unimportant the conventional distinctions which occur in this world. Veneration, while occupying the highest point, should rule the other faculties. The acts of life should be subordinate to the will of the God of the good and true, or to the principles of goodness and truth in the abstract.

Benevolence is one of the better sentiments, and should occupy in the mind an elevated position. As in the natural head it is placed over acquisitiveness and behind judgment, so should it be in the mind. Let it preside over the love of gain, and dispense the wealth which that love stimulates us to accumulate. But as the organ of comparison or judgment is placed before it on the head, so the hand of charity ought to be guided by a power of justly discriminating among the many ostensible objects of its regard. To give

to the vicious and indolent, whenever they ask assistance and appear to need it, might gratify the feeling of benevolence; but, when an honest judgment goes before, the hand will be withheld from its spontaneous, but misguided charity.

Conscientiousness and firmness are placed over the propensities. They should maintain in the mental constitution a station analogous to their physical one, — should be elevated and central, holding the social affections and merely sensual appetites subordinate, and preserving in harmony and orderly subjection what in our constitution would otherwise be selfish and wayward in a high degree.

The analogy of the different organs might easily be traced further, and found to hold equally true.

It may be evident to the most casual observer, that in the moral world the perfect order just alluded to is not found; and it is easy to conceive, that man's happiness and usefulness will be much increased, as his interior qualities become more like the orderly physical development which he sometimes possesses.

104. The hands and feet respectively correspond to the interiors and exteriors of man. Now, no animal except man has a hand (25), and few of them any member which is at all analogous to it, which is not also used for the same purposes as the feet are; and none but he has a living soul, — an immortal or internal part, of which the hand is an emblem. As the feet are beneath all other parts, so the mere external part of our affections should hold a relatively inferior grade. But the outward, every-day acts of life form

the basis on which the moral structure must rest, and constitute the most tangible evidence of rectitude, as fruit declares the nature of the tree.

The internal of man to which the right hand corresponds should never be trammelled by being brought down to the office of the foot, but retain its wide range of motion, and the higher order of uses to which it is adapted ; for scientifics, grounded in what is sensuous and natural merely (feet and hoofs), belong only to the natural man, and cannot elevate his moral nature.

105. In proportion as natural civilization advances, we see the more ferocious beasts of prey receding into their still remaining forests ; and our imaginations can look forward to the day when “the wilderness shall become a fruitful field, the desert blossom as the rose,” and their savage inhabitants cease to devour. But in pace with this change in external nature, must be the more important one in mankind. Those evil passions and false principles, in all their ferocity and variety, to which the wild beasts correspond, must be subdued and put away for many successive generations, till the heart of man shall become a spiritual garden, a paradise for the reception of angelic visitors.

THE SEXES AND TEMPERAMENTS.

106. Most of the doctrines taught and descriptions given in Physiology will apply alike to the male and female ; but there are a few sexual peculiarities which seem to demand a separate consideration. These peculiarities are not confined merely to the diversity in outward form, but extend through all that constitutes the human being.

In the male, the head is generally somewhat larger, the skull is a little thicker, and capable of sustaining a heavier blow. The forehead is broader and higher, and the surface of the whole cranium more ridgy and uneven. The organs of amateness, combativeness, and destructiveness, are considered by phrenologists to be more fully developed. The face is much more rough, the features of the countenance more strongly marked, so that his portrait is more easily drawn by an artist than that of the female. At the age of from fourteen to eighteen, the chin and lower part of the face are covered with a growth of soft beard, which gradually becomes more coarse and grizzly as age advances. At the same period of life, a singular change takes place in the neck, which, in the short space of a year or two, increases one-third in thickness ; the larynx enlarges, so as to form a movable prominence in the upper and front part of the throat, commonly called Adam's apple. In consequence of this enlargement of the larynx, the voice suddenly alters its tone to about an octave

lower than its former natural pitch. During that period, while the voice is breaking, as it is called, the muscles about the larynx, not being at first adapted to the change which has taken place, cannot control the delicate apparatus which forms the voice; and the individual, when about to speak, hardly knows whether he is going to use the treble or bass key; and sometimes, in the utterance of a simple sentence, will, against his inclination, have recourse to both.

107. The shoulders are considerably further apart, and the chest broader, than in the female; while, the pelvis being narrower, a line let fall perpendicularly from the outer edge of the shoulder would not touch the hips. But, in the case of the female, the shoulders being near together and the pelvis broader, the line would fall within the circumference of the latter. By a knowledge of this circumstance, if a skeleton be found, it can generally be decided to which sex it belongs.

108. The muscles are uniformly larger and of a more solid texture than in females of a similar condition in life; but, as the development of the muscular system depends much upon the amount of bodily labor performed, where females are subjected to severe toil, and men lead an idle life, *their* muscular system will be proportionably larger. This is noted by travellers among the Western Indians, where the more servile labor is performed by the squaws, while their husbands and brothers are lounging about their wigwams, or engaged in hunting or in some kind of amusement.

Males are generally of a considerably larger size than females, being, on an average, as four to three;

and their physical strength and degree of bodily energy manifest a still greater difference.

109. The female head is quite free from large protuberances, but generally even, and has the different developments more evenly balanced. The organs of philoprogenitiveness, secretiveness, adhesiveness, and benevolence, are more uniformly found large than otherwise, in their relation to others.

The face is smooth and fair, and generally mild in its expression; but seldom indicates so much marked character as exists in the opposite sex.

110. At the age of puberty, which, in the temperate climates, is at from thirteen to sixteen years, the breasts become developed, and form one of the most distinctive marks of the sex.

The limbs are round, plump, and symmetrical; the muscles being, in most subjects, enveloped in a large amount of fat. The relative length of the body is greater, and that of the lower limbs, consequently, less; so that, if a man and woman be sitting beside each other, they will appear to be of a nearly equal height; but, if they stand up, the man will be seen to be much the taller.

111. There probably never have been, and never will be, found two individuals precisely alike; but there are classes, in which the individuals who compose them resemble each other more than they do those of other classes; and this has led to a division, founded in nature, of men into four temperaments, — each being distinguished by certain peculiar characteristics.

Were the males and females of any one temperament to confine themselves, in their marriages, to those of the same temperament, or one similar to their own, these distinctions would become more strongly marked in each succeeding generation. This has been much the case with the Gypsies, and, to some degree, with the Spaniards; but, in this country, the reverse seems likely to prevail. Even now, it is rare to meet with a marked temperament of either kind, without some admixture of one or more others.

112. There are usually allowed to be four temperaments; the Sanguine, the Bilious, the Phlegmatic, and the Nervous; while some have added a fifth,—the Melancholie.

113. The sanguine is characterized by a fair, animated countenance, capable of expressing a variety of emotions; by full, but not hard muscles, and, consequently, the limbs will have an agreeable roundness. The circulation of the blood will be full and considerably rapid; the bloodvessels often prominent and generally large. The prevailing color of the eyes is blue; the skin is fair or freckled; the hair is light or auburn; and the features are smooth and even.

Persons of this temperament are fond of bodily exertion, and, if addicted to amusements, choose such as call into action a tolerable amount of muscular force. They are not often devoted to close mental application, and are seldom capable of much uninterrupted study. Though willing to exercise their muscles, they are not well fitted for long-continued and severe bodily labor. They are apt to be rather volatile, and

generally fond of change. Their passions are ardent, but not lasting.

114. The bilious temperament is marked by a yellowish skin, dark eyes, and black hair. The countenance is often rough and displeasing, but sometimes animated and expressive; the eye is quite piercing, and bespeaks strong inward feelings; the body is strongly built; the muscles firm, hard, and well developed, but seldom surrounded by much fatty substance. There is not much vivacity in expression or action; but a settled purpose or determination seems fixed upon every lineament.

Those of this class are capable of great physical exertion, and that continued for a long time. They are also capable of doing much good or much evil, and often act a prominent part on the stage of life. Their passions are deeply rooted. They are not, by any means, insensible to bodily pain, but still will bear much of it without complaining.

Many of our Indians are good specimens of this temperament.

115. The phlegmatic, or lymphatic, betokens a fullness and softness in the flesh, which is abundant, and often is an encumbrance to the wearer. The complexion is very fair, but deficient in color; the hair is soft and silky; the eyes, which are heavy and dull, are often of a grey cast; the lips are thick; the features rounded and heavy; and the motions slow.

The disposition is mild and sluggish; and the individual will be contented with enough to eat and little to do. They suffer reverses with calmness, endure

pain in silence, and bear losses with patience ; and no privation makes them so fretful as delay or deficiency of their ordinary food. Unlike the bilious, they seem incapable of much good or much harm, and generally lead a peaceable life, — a circumstance which is owing, in a great degree, to their aversion to bodily or mental exercise. Some few men of this temperament have, for a time, aroused themselves to exertion, and attained a degree of eminence ; but such instances are rare, unless where there is some admixture of the nervous or bilious.

116. The nervous is generally an active, uneasy temperament, and might well be put in opposition to the last. It is characterized by sharp, thin features ; general leanness of the body and limbs ; and a restless, sharp eye, of much brilliancy and meaning.

This is generally an unhappy temperament, both to the individual and his associates ; but, as it is commonly attended by a well-informed mind, its possessor is often an object of general interest. Men of this class excel more in intellectual than in bodily power, and are seldom able to go through with much bodily exertion. Their studies are not followed up with steadiness and patient investigation ; but their progress in them is rapid and uneven. They are men of genius, but too often deficient in practical knowledge. They enjoy life, for short seasons, with peculiar zest ; and their mental agony is equally acute. Their actions are more the result of impulse than of deliberation.

The women, when young, possess attractions almost irresistible ; and, when old, are a torment to

themselves, and a calamity to societies in which they happen to reside.

117. That wretched temperament, called the melancholic, I think, should have a place among the others at present; but it is to be hoped it will only be found eventually among the records of the past. Its peculiar marks are a dark skin (or, if not dark, of the appearance of parchment); the features lank, with a cast of countenance as cold and repulsive as the month of November; the eyes, though often dark, are neither animated nor expressive, and are deeply imbedded in their sockets; the face is long, the cheeks sunken, the hair black and straight, and generally allowed to grow long; the bones are large, and the joints prominent.

The victims of this temperament are gloomy in disposition, unsocial and foreboding. They are not addicted to excesses either in eating, drinking, or other sensual pleasures. They attend funerals, executions, criminal trials, and the ordinary scenes of calamity; and act as Job's comforters to those in distress.

They commonly believe in predestination, reprobation, and future punishment by brimstone, and take delight (if delight can be predicated of them) in discoursing upon the miseries of hell-fire. They hold faith alone in high estimation, and the works of charity in utter abomination, as being meritorious. The men sometimes marry hopeless old maids; and the women, if there be any of this temperament, probably die single.

The term *melancholic* is from two Greek words,

melan (black) and *cholē* (bile); as the old humoral pathologists supposed that its peculiarities originated in the presence of a dark, viscid kind of bile in the system.

118. It is seldom that individuals are met with, who do not combine in their constitution two or more of the temperaments; and these, occurring in almost every proportion, are productive of favorable results. The sanguine and bilious, united, give great physical strength and endurance, sufficient vivacity and animation; and the subject is well fitted for any kind of bodily labor, and may have a sound, practical mind. The nervous and bilious, with a little of the sanguine, forms the best combination for intellectual superiority; while a moderate share of the phlegmatic, added to either of the others, improves the personal appearance, and conduces to a more even disposition.

ANALOGY OF THE SEXES AND TEMPERA- MENTS.

119. When man and woman are spoken of in contradistinction, man represents or corresponds to the understanding, and woman to the will. The male principle also corresponds to truth, and the female to good. The reason for these correspondences seems stamped upon every feature of man's economy; for it is by intelligence and the power of truth he excels, and much admixture of the softer affections renders him effeminate.

120. The intellect does not win by its gentle tones,

but seems rather to rule by a compulsive power. We admire and appreciate the strength of its arguments, and yield ourselves captive to the power of its reasonings. But the features of it are rigid and unyielding (106), and so tangible that we can easily delineate them all. It speaks to us often in a voice which is deep and gruff.

121. Truth may bind us with the grip of a giant, but alone cannot draw us by the gentler cords of love. We venerate his manly form, are even filled with admiration at the firmness and herculean proportions of all his limbs, and quail before the frown of his searching eye. If we have violated his stern rules, we dare not confront him, and would gladly hide our faces in the folds of the garments of sophistry. In his anger we dread to feel his iron grasp, and know it would be vain to contend with the strength of his sinewy arm. It is only when we have been obedient to his mandates that we cease to feel our former dread. We then approach him with confidence, and rejoice in the protection of his powerful hand.

122. The general aspect of goodness is mild. She has her seat in the affections, and all her actions proceed from love. She gains our hearts by her kind and gentle manners, and delights us by the melody and softness of her voice. We love to dwell upon the remembrance of her features; but they were so fair and even (109) that we find it difficult to retrace her portrait in our memory. If we are in her service, our toil is light and pleasing; and no one is so dull that he cannot know his task. Even if we have been dis-

obedient, we are not afraid to meet her, but grieve at heart that we have so ill repaid her kindness.

123. The union of these heavenly principles in the human mind, by a celestial marriage, forms the consummation of the regenerate state. When we live a good life, not only in obedience to Truth, but in the love of Goodness itself, the yoke of bondage is taken from our necks, and "we are free indeed." Then man has a heaven in the chambers of his own mind, and the primary constituents of celestial joys. Then the romance of human life winds up with the happy union of these holy principles.

124. Among the various classes of religious people, there may be found those whose peculiarities will illustrate the different temperaments. Their physical characteristics may be quite dissimilar; and in their religious life only do they exhibit those features of resemblance which constitute the basis of their classification. Thus, in one religious society or church, we see arranged under the same tenets the robust and the feeble, the impetuous and the dilatory. Still all join in the same course of conduct; and each, during that course, will be noted for his own peculiar mental or moral habits.

125. Some are quick in their perceptions, ever ready for something new. The truth seems to circulate rapidly through their minds. They are animated and ready for exertion, and commence the work of reformation with a willing mind. There is nothing reluctant in their movements, but all seems to proceed with cheerfulness. They do not merely talk of spiri-

tual things, but are equally ready to act (113); and begin to build houses of worship, distribute religious books, and make other donations to support the cause which they believe to be worthy of their attention, and to promote doctrines which they believe to be true. But their efforts are of short duration, and their thoughts become turned from subjects of piety, with the same facility that they had been turned to them. Their devotions, too, are vehement, but too transient to leave much effect upon the mind. Their conversion is almost instantaneous, and their back-sliding equally so.

126. Another class is distinguished for a steady course, not much influenced by surrounding opinions. Their doctrines are quite firmly woven together, and present a rough, unyielding aspect. Religion, by them, is not arrayed in her fairest vestments, but in the strong, plain garb of unwavering rectitude, fastened up with some of the brazen buttons of self-righteousness. Their power of endurance and steady perseverance (114) are praiseworthy; but they have too little of the milk of human kindness in their breasts, and trust too often to their own unaided strength.

127. A third class presents itself, of easy, inoffensive habits, and a mild, peaceful expression. Its members are at ease in Zion, and would prefer not to be disturbed with any other than the negative or passive creed which they already cherish. This creed is smooth and fair in its complexion, but so devoid of color (115) that it is difficult to say whether it has

any thing really vital in it. Its features are rounded to avoid giving offence, and the languid smile of spiritual indolence is all that animates its placid countenance.

Its votaries are in keeping with these easy principles; manifesting, in their smooth, red cheeks, their corpulence and their portly bearing, far more of the evidences of generous living than of the cares and crosses which occur in a religious life in this world.

128. Another class exists, quite different from the preceding. With a great readiness to investigate all doctrinal points, and a capacity to penetrate into the most subtle mysteries of any creed, they combine too little practical utility. They can more easily explain the theory, than put into practice the rules, of life. Still they have a degree of duty to discharge; and, by their fitful energy of mind, something is added to the store of general knowledge, or hints thrown out for others to act upon.

129. A gloomy and ascetic class still remains, whose very look is "the titlepage of misery." Viewing religion through a smoked glass, they believe and teach others that she is shrouded in gloom. She holds out to their jaundiced vision a life of penance and mortification as the only path to heaven, but such a heaven as no one else would wish to enter.

130. A happy union of the better qualities found in the preceding classes is necessary to perfect the spiritual temperament. Thus, the willing mind and prompt action of the first, the rectitude and steady perseverance of the second, the peaceful mildness and

urbanity of the third, with the mental energy of the fourth, would form a combination as free from faults, in a moral point of view, as the union of the natural temperaments would present in the physical constitution of man.

D I G E S T I O N . *

131. The digestion and assimilation of the food is that process by which we daily receive life, through the materials by which life is sustained.

Most of the external organs are subservient to the procuring of food; but those which digest it when procured, and assimilate it, or cause it to become part of the body itself, are quite distinct in the functions which they as a class discharge. They may be said to commence with the mouth.

132. This organ consists of the lips and part of the cheeks, whose office is to retain the food in its proper place; of the tongue, whose office is to taste and ascertain the peculiarities and suitableness of the substances submitted to its examination, and move it about as may be necessary; of the teeth, whose office is to break up, and reduce to a pulp, whatever is submitted to their action; and, lastly, of the fauces, at the back part of the tongue, whose office is to receive the food when properly chewed, and pass it to the

* This section was written some time ago, by the author, as an article for the N. J. Magazine, and appeared in the number for April, 1842.

œsophagus or gullet, which conveys it thence to the stomach.

133. The lips are composed of web-like, pliable, delicate muscles, covered externally by skin of a strong texture, and within by a delicate, membranous lining, which is perforated by many small, salivary ducts. Although the lips are firm, they are capable of great extension, to enable them to receive substances of considerable size into the cavity of the mouth; and the minute structure of the muscles, together with their abundance of cellular tissue, enable them to apply themselves to each other so closely as to exclude every improper substance, while every suitable kind of food is retained and protected, while undergoing the process of mastication. In man the lips are perfect; but, in the lower orders of animals, they grow less and less so, as we descend in the scale; till, in the crocodile and reptiles, they entirely cease to exist.

134. The tongue is similar to the lips in substance, but more definite in its office; and, having a larger distribution of the nerve of taste, it can discern more nicely the qualities of such substances as are within its reach; while its flexibility enables it to move the morsel of food from one part of the mouth to another with exactness, and finally to throw it backwards to the fauces, or entrance of the gullet.

135. The teeth are hard substances, the roots and internal parts of which are composed of bone, surmounted by the crown, or visible part, which is composed mostly of a very hard, glossy enamel, capable

of breaking up, or reducing to powder or pulp, quite hard and tough substances. Their office is not of an elevated kind, being of a mechanical nature, but generally necessary in proportion to the hardness and toughness of the solid food.

136. In addition to the above parts, there is also a class of glands for the secretion of the saliva, a fluid similar in appearance to water, but possessing strong solvent powers, combined with something mucilaginous and adhesive. These glands, in a minute amount, are found in the lips and cheeks, and in quite a mass near the angle of the under jaw, and in a smaller collection under the tongue. Their location is admirably adapted to further their usefulness, as they are somewhat passive, have but few nerves, and at times need some foreign power to stimulate them to increased action. This power is supplied by the jaws and tongue, which move constantly and forcibly while chewing the food; at which time, a free supply of this fluid is called for, to be mixed with it, as it is ground up by the teeth.

137. Solid and liquid substances taken into the mouth, having been thoroughly chewed and intimately commixed with the saliva, are taken in a pulpy state by the fauces, assisted by the back part of the tongue, and crowded into the œsophagus, through which the mass is conveyed to the stomach by the act of swallowing.

138. The stomach is a kind of bag or pouch, capable of containing (in an adult) nearly a quart on an average, and having an orifice at each end. It is

composed of an external coat, which is membranous ; a central, which is muscular ; and an internal, which is also membranous, lined or supplied with a wrinkled, velvety coating.

By the stomach a peculiar fluid is secreted and poured out upon the pulp which it now contains. This fluid, called the gastric juice, is a powerful solvent, which acts upon the food to reduce it to a more homogeneous mass, which is called chyme. — This process of chymification is not wholly produced by the gastric juice, but partly by the peculiar motion of the stomach, and assisted further by a uniformly warm temperature, which is sometimes kept up at the expense of the rest of the system. For, in consequence of the unusual demand for heat by the stomach, during the term of digestion, some part of the general warmth of the body is abstracted to supply it, and the whole system then experiences a temporary chilliness.

During this stage of the process, the lower or pyloric orifice is closed, and the upper or cardiac one is nearly so. This is necessary to prevent any part of the indigested contents from passing downwards, and to allow no unsuitable substances to enter from below, and disturb the process of chymification, which is now going on within it. It is also injurious to force open the upper orifice much by swallowing, as is often done by those who eat frequently. Still this orifice is not so arbitrarily closed as the pyloric is ; otherwise it would prevent the frequent admission of saliva, which conduces much to this part of digestion.

139. After the food is thus reduced to chyme, the lower orifice of the stomach opens, and the more homogeneous parts of the contents pass downwards into the duodenum. Soon afterwards, the remaining parts of the food in the stomach pass downwards gradually as they become chymified, till, in about half an hour from the opening of the pylorus, this organ will be left quite empty, and will thus remain at rest, till food is again admitted into it.

140. The duodenum is a muscular, membranous sac, about a foot long, capable of considerable dilatation to receive the chyme, and is much more passive than the stomach. Here the mass remains some time, to undergo the further process of chylifaction, before it will be suited to nourish the body. This process is performed by the addition of fluids poured out by the pancreas (a gland much like those which secrete the saliva), by the coats of the duodenum, by the omentum, and by the liver, whose secretion, called bile, is very abundant, of a yellow or greenish color, and of a disagreeable bitter taste. The use of this last secretion is chiefly to unite itself with the worthless and indigestible parts of the chyme, and to move downwards with this excrementitious mass, till it passes out of the body, to whose well-being it can no longer contribute. The bile is an excrementitious part of the blood, containing no nutritious qualities, but being poisonous to the whole system, if obstructed, or allowed to remain in the blood or wholesome fluids of the body; and for this reason it is wisely endowed with such qualities as render it unwelcome longer in the containing

viscera; and it has also a propensity to leave a place where it is a burden.

141. The chyle now formed is a bland, milky fluid, of a very composite nature, being formed from the nutritious part of vegetable or animal substances, and of the various secretions which are mixed with it in its passage. In chemical composition, it can hardly be distinguished from albumen, of which it seems mostly to consist. It is now taken up by minute, whitish vessels, called lacteals, which are situated in abundance along the membrane which lines the duodenum, and also (but less numerous) along the course of the smaller intestines, and suck up every particle or drop of chyle which comes within their reach. This they carry to the thoracic duct, by which it is poured into the *vena cava*, a large vein in the upper part of the chest, where it mixes with the blood, and is thus emptied into the heart.

142. The process of digestion is now nearly completed; but one step of importance remains: this is the exposure of the blood, thus enriched, to the action or influence of the air, which vivifies or gives life to the whole. For this purpose, the blood is thrown, by the pump-like action of the right side of the heart, through a short artery into the lungs; where it is spread out, in myriads of small cells, and exposed to the air, which at every breath is received into the lungs, and acts upon the blood thus exposed, which, by its influence, is changed from a dark purple, sluggish fluid to a bright scarlet, lively one, which is now ready to nourish the whole body. This blood is now re-

turned to the left side of the heart by a short vein, and, by the powerful action of this muscular organ, is sent at every pulsation, through the large and long arteries, to every part of the system. It is now taken and appropriated or assimilated by every organ or part, according to the form and office of each. Thus in the fleshy or muscular parts it becomes flesh, on the surface of the body it becomes skin, and in the framework of the same it becomes bone; each member receiving day by day its daily nourishment from the common source.

The whole of the blood is by no means assimilated, but only such part as conduces to the nourishment of each organ to which the blood flows; and this nutritive principle is appropriated from an inherent power existing throughout the body, and variously manifested according to the peculiarity of the tissues.

143. In a healthy state, all parts are alike nourished, and the whole process of digestion and assimilation is attended by pleasurable sensations. But certain laws exist in the animal economy, the observance of which is necessary to maintain a healthy state of things. The nourishment appropriated by every part must be expended in external acts. There must be a stimulus of demand, caused by vigorous action, that every thing may be brought out into ultimate acts or practical duties. The food should be of a wholesome kind, and not taken in too large a quantity, nor yet too sparingly. The intervals should be nearly regular. And in proportion as man is in an artificial state, it should be prepared by dressing or cooking.

In a perfectly natural or savage state, this is rendered unnecessary by their strong digestive powers and simple mode of life. The food should consist of a suitable proportion of solids and liquids. It is unimportant whether they are taken together or separately; but they must each form a part of the contents of the stomach. A variety of food conduces to the proper growth of the body; but it is not absolutely necessary, any further than relates to a just proportion of solid food and drink, except as our hereditary propensities or artificial state make it so.

ANALOGY OF DIGESTION.

144. All moral or spiritual food requires digestion and appropriation, before it can nourish the soul, and become part of ourselves. It must go through every part of the process; must be incorporated with such good and true principles as previously existed within us as the remains of some previous instructions or example; must be acted upon by inward thoughts and affections of the mind; must undergo a process of separation (whereby that which will not conduce to our spiritual growth may be rejected); must be gradually received in the interiors of the mind in a manner analogous to absorption; must be vivified by an atmosphere truly spiritual; and finally must enter into every organ and member of the soul, and thus give them strength to discharge their moral duties, or descend into the very acts of every-day life, and fill them with heavenly influences.

145. What the mouth is to the natural body, the memory is to the soul. It is in the memory that the food of the mind is first received, before it becomes acted upon by the mental powers. Then the first process of spiritual digestion is the receiving into the memory and thoughts such ideas, instructions, or moral influences, as can suitably nourish the soul, and would consequently correspond to natural food, or food for the body.

As no natural food consists of that which is entirely nourishing, but also contains many ingredients which are subsequently cast off as indigestible, and therefore useless; so our spiritual food, as we receive it in the ordinary course of life, consists not only of the knowledges of what is good and true, which are nutritive, but also of many things evil and false, which are not so. And some men are in so external or inverted a state, that they cannot be profited by any thing which is purely good and true, but require it to be mingled with something more adapted to their own evil and false tastes. If offered to them in the former state, they immediately reject it, saying it is too holy or sanctified for them, but will be profited by it, if diluted or adulterated with some ideas which they have been accustomed to cherish, and which they can more easily appreciate; like most of the lower animals, which would become diseased by the use of food in the concentrated state in which man uses it, but will thrive well on such things, if mixed with some coarse materials which man could not digest.

Many ideas of a doctrinal, scientific, or moral nature,

when received into the memory, are so far from being congenial to the internal man, that they have to be acted upon by the sensual parts of the understanding, which bear the same relation to the mind which the teeth do to the body ; and, by reasonings, are reduced to a state more suitable for inward reception. This process is not necessary with all spiritual food, as there is much which is received by a gentle influx, and, consisting of what is good and true in a blended state, does not require to be chewed over or ruminated upon ; but, like a homogeneous pulpy mass, is ready for the mind to drink it in with ease.

146. The lips correspond to doctrine ; and why they do so, is readily seen. For as the lips are necessary to retain the natural food while being chewed, so is some system of opinions or doctrine necessary to collect and retain the ideas, while the mind is examining them, preparatory to a right understanding of what relates to spiritual life. As the lips are formed in the mother's womb, so some kind of doctrine, or class of religious views, is generated in the mind, during its formative state. Thus we find that those whose minds are awakened to serious subjects among the Baptists examine all contested points by the light of, and agreeably to, the doctrine of the Baptists ; those who become interested in religion among the Methodists examine all things by the rules of the Methodists ; and the same is true of other sects. Indeed it is very rare that a person who "experiences religion" within the pale of one sect unites with a different church.

As there are diversities in the degree of development of the lips of the several classes of animals, and as they are perfect only in man and some few species which nearly resemble him, so there are almost infinite grades in the perfection of doctrine of different sects. Some are in so low or reptile a state (133), that it is difficult to say that they have any kind of doctrine; others are more elevated, and have some system of opinions, which, bearing an analogy to the lips of the ox, serve partially to keep their thoughts in an orderly state; but their sensual reasonings are apparent when they canvas moral subjects, as the teeth of the ox are visible while he is chewing his food.

147. The tongue, as an organ of taste, signifies affection of good; and as such it fills an important office, in the selection of that which affords wholesome nourishment for the mind. Without an affection for what is good, we are at any time liable to lay hold of that which is evil, and select it as moral nourishment; but, *with* this affection, we are guided with instinctive safety to the selection of what will prove salutary, if willingly received, morally digested, and practically assimilated.

Those things which pertain to knowledge, science, or devotional duties, having been selected by a sincere affection for what is good, kept in the mind by a system of reflection, and if necessary submitted to the examination of the senses, now require to be combined with some part of our own selfhood, something like the gastric juice and saliva of the natural system;

and then it will be so interiorly imbibed by the soul that it will become part of the mind itself.

148. The human understanding answers the purpose of a stomach to the soul. It is when ideas, which have been admitted into the memory, are still further received into the understanding and deliberately reasoned or reflected upon by its powers, that a more interior or complicate part of the digestive process takes place. And man is spiritually growing stronger, by a process analogous to the strengthening of the body by the natural digestion of the food in the stomach, when he meditates seriously upon what concerns his own future state, his present duties, or what relates to the well-being of others.

149. The good and truth presented to us, having been separated from any thing evil or false previously combined with it, having been acted upon and amalgamated with the *remains* of former sustenance (that part which is unsuited to our state having been carried away with our latent evils), are now to be vivified by influx from above,—are to be made spiritual.

150. In natural digestion, all the nutritious part of the food, having passed through the several preparatory stages, was received with the blood into the heart, thence transmitted to the lungs, where it received the enlivening influence of the air.

This part of the process of spiritual digestion is in some degree plain, and its correspondence, so far as we can trace it, beautiful. The heart corresponds to love in the will; the lungs, to faith in the under-

standing ; natural respiration, to internal respiration, which opens communication with heaven. Breath of the nostrils signifies celestial or essential life, which is from the Lord only ; and air-vessels in the lungs signify perception, — the power by which man becomes conscious of spiritual influences. Now, the various aliments, having gone through the previous stages, must be received by love in the will, submitted to the influence of faith in the understanding, where, by internal respiration, celestial life from the Lord is inhaled, to give true spiritual life to nourishment which would otherwise remain natural. This Divine Truth and holy principle of Charity, to which the blood corresponds, is now to be received and to circulate through every part of the soul, and to nourish it according to its power of reception : it is to be appropriated, and to become part of self.

The soul, being thereby invigorated, is not to remain inert, but, by its operations on and through the natural body, expend the strength now acquired in various duties, and thus be ready to be further nourished by every good and truth daily received from a heavenly source. In an orderly state of things, this process of spiritual digestion would be accompanied by the most gentle and agreeable sensations of the mind.

151. The greater part of the world require the goods and truths designed for their nutrition to be prepared for them, and presented in a palatable form ; and it is highly important, that clergymen, and other teachers who fill the office of cooks for the mind,

should, in their sermons and lectures (which are useful “made-up” dishes), seek rather to serve up plain, wholesome, practical truths, and promote the welfare of the soul, than to pamper the fastidious palates of their hearers, and gain the reputation of accomplished *artistes*, at the peril of the health of those moral *gourmands* who listen with avidity to their compositions. A morbid appetite sometimes exists for faith alone, — for truth unmixed with good ; but as it would be improper to command a stone to be made bread, so it would be wrong to substitute natural truth for natural good : also, as man is not to live by bread alone, it would be equally wrong to separate good from its accompanying truth.

152. The forms of spiritual nourishment are various. Not only religious knowledge and devotional services, but the sciences, social and intellectual enjoyments, the ordinary duties and employments of life, the events of Providence towards us, exhilarating and harmless amusements, and the many forms of love and wisdom we are daily receiving, either from our friends or the gentle influence of spirits about us, contribute to our nourishment. External trials and privations sometimes serve as food, but oftener as medicine for internal disorders. There is, therefore, hardly an occurrence in life, which, if rightly appropriated, will not prove a kind of nutriment for the soul, or a healing balm for its many maladies.

Spiritual food, like natural, should not be taken in too large quantities. It should be received just as fast as it can pass through the successive stages of

digestion, become assimilated or made part of the mind or soul, and go forth into useful, ultimate acts. If taken faster than this, it will either cause vomiting, that is, a rejection of good and truth commixed; or cause dyspepsia, which is sadness from the "infestation of certain spirits, who, having recently departed from the body, are not yet joined to hell, and delight in meats corrupted in the stomach." * If taken too sparingly, a moral debility ensues. This is often seen in communities or with individuals, when there is no regular source from which they can derive food for the mind. They become gradually more and more feeble in their efforts to lead a virtuous life, till they finally sink into a state of apathy towards religion, and yield themselves up wholly to worldly influences.

153. By those who accustom themselves to much bodily exercise, a stimulus of demand was said (143) to be produced, and digestion accelerated. This is also emphatically true in reference to the soul. *If any one will do His will, he shall know of the doctrine, whether it be true.* If any one will first live up to the little knowledge he now has, he shall be prepared by this very act to receive more; and if he but imperfectly understands any truth or any duty, by living up to it agreeably to his best judgment, he will by that means see it more and more clearly. To crave spiritual food, not for ultimate usefulness, but to satisfy a vain curiosity, or lay in store a fund of self-righteousness to gratify the palate only, is gluttony; and will either lead to moral disease or spiri-

* Swedenborg.

tual corpulence, by which all the healthy motions are impeded. And to thirst for spiritual drink, not that the mind may be enlightened and enlivened thereby, for the better performance of the duties of social and religious life, but for the sake of knowledge in the abstract, or as a means of advancing ourselves above others, is a species of spiritual intoxication, where the mind roams delighted in its ideal heaven, but the external movements are tottering and uncertain; and, though wise in its own conceit, appears very foolish to others.

As in the natural body there is no so effectual a remedy for dyspepsia as actual labor, so in the soul nothing will so promote a healthy state as the continual endeavor to bring down into ultimate acts the spiritual nourishment we are daily receiving; and, by living out the goods and truths we have already received, we shall be able to receive much more than we could otherwise understand.

154. As a society is but a man in a larger form, the same laws and rules which apply to the one, will in a good degree apply to the other. Thus, for example, a society is nourished and made to grow in part by the addition of members to it. But these members must be united by a regular process of preparation precisely similar to digestion, that they may become assimilated, so as to be a real part of the general body; having in themselves nothing dissimilar or repulsive, which would necessarily cause pain and sadness to the other members. Similar rules for the well-being of a society will also apply as they do to

the case of the individual. If members are admitted faster than they can be rendered congenial to and incorporated with the main body, they must either be ejected by an expulsive action similar to vomiting, soon after their admission; or, remaining some time, will cause much pain and melancholy to the rest, and will then unite with the gall of the society and pass out, partly of their own accord, and partly by the effort of the rest of the body; leaving it in a worse and more enfeebled state than if they had never been received, but sometimes purging it from some previously existing impurities.

155. For the healthful completion of the last process of spiritual digestion, or the purifying agency of the Divine influence, analogous to the oxygenation of the blood by the contact of the air, it is necessary that the heavenly sphere should be as free as possible from the contamination of false principles; for much depends upon the purity of the vital air. We know that the natural atmosphere is frequently rendered deleterious by the presence of noxious effluvia from decomposing substances: so are the moral influences around us often so replete with the miasm of false doctrines, and their consequent corrupting tendencies, and of systems already in state of partial decay, as much to impede the feeble respiration of an infant church. And it is the unceasing effort of evil spirits to pervert that element which once was breathed in its purity.

As the effect of climate and locality is great upon many, it is desirable that they should be placed, as

far as is practicable, within the beneficial influence of virtuous society. And all should avoid, as they would a pestilence, the proximity of those who are grossly immoral in practice or artfully false in principle, unless it be in the capacity of ministering spirits to disinfect their poisonous atmosphere.

THE BLOOD.

156. The outward appearance of the blood is very familiar to all, as a fluid rather thicker and heavier than water, and of a deep red color ; but few have an idea of the complexity of its properties, and of the many peculiarities which it exhibits.

The red color, which is universal in the higher orders, is not found throughout the animal kingdom ; but in the molluscous and radiate tribes the prevalent color is that of water, and causes them to be distinguished by the term *white-blooded*. The coloring matter, therefore, can hardly be considered a necessary constituent, inasmuch as it is not always found ; and the vital properties, in those low orders at least, subserve the purposes of the animal economy without its presence. Still it is uniformly met with in the vertebrate animals, and becomes purple or florid, according to certain states which it passes through.

167. In man and other mammalia, its temperature

seldom varies materially from ninety-eight degrees of Fahrenheit. It, however, does vary some in every individual ; being raised in fever or by long exposure to a high temperature, and lowered by exposure to extreme cold. But these variations are much less than we should suppose, considering the extensive and sudden changes in the temperature of that medium by which we are surrounded.

In birds, whose circulation is rapid, and whose bodily exertion at times is much greater than that of land-animals, the temperature is about 140° ; differing, however, according to the severity of their exertions, and the peculiar mode of life habitually pursued ; while, in fishes and reptiles, it is but a degree or two above that of the atmosphere or water in which they are placed.

168. The blood differs considerably in different individuals, and in the same individual at different times, as to the amount of solid matter which it contains in its composition, and consequently there will be quite a difference in its specific gravity ; but it will generally be from three to six per cent heavier than water. This additional weight must, of course, depend upon the presence of solid matter, either suspended or dissolved in the fluid. Those have the heaviest who live mostly on food in a solid or condensed state, lead temperate lives, and are daily devoted to some laborious occupation ; while delicate females, and men of sedentary habits, may be free from bodily disease, and enjoy a kind of negative health, with blood which is nearly as light as water, and

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whose temperature will range a few degrees below the standard of one in robust health.

169. Its first prominent division is into serum and crassamentum ; though, to arrive at any thing like a proper knowledge of it, a more minute study of its component parts will be necessary. This division is not arbitrary ; for, on being drawn, it of itself separates into two parts, — the serum rising like water, and the crassamentum forming a clot at or near the bottom of the vessel. This separation is not always effected in the same space of time, but may vary from circumstances presently (179) to be mentioned.

170. The serum is the more fluid part of the blood, and almost devoid of color. It is a little heavier than water, owing to the presence of some salts held in solution, and to the albumen it contains. It consists of ninety per cent of water, whose use, besides its solvent power, which of itself is highly important, is to give fluidity to the whole substance, and thus enable it to traverse those extremely minute vessels which would be impermeable to any thing in a semi-fluid state.

Albumen* constitutes the greater portion of the solid part of the serum, and is the most nutritious principle in the blood : it seems to be the *pabulum vitæ* to almost every tissue, and is abundantly furnished by the latter stages of the digestive process. By exposing the fluid to a high temperature, this coagulates in the form of floating curds, and may be separated from the remaining part.

* This substance is almost identical with the white of an egg.

A peculiar oily matter is found, small in quantity, but differing in its qualities from the other fat of the system. This has been supposed by some physiologists to be the peculiar oily principle of the bile, by others that of the brain, and by others that of the common fat; while the truth probably is, that it contains a substance or principle which may become either or all of these, as it is received and appropriated by the several textures.

171. The crassamentum or clot is of a more composite nature than the serum; from which it also differs, in containing the coloring matter which is insoluble in the latter. This coloring ingredient was formerly supposed to be oxide of iron, which always exists in the blood. But recent experiments have shown that it will still remain after all the iron has been removed by the action of acids. It therefore is now admitted to be a peculiar animal principle, so intimately united with the other parts as to be inseparable without deranging the fluid. This coloring is connected specially with an important component of the blood, called the globules or discs.

172. These globules are very minute in all animals, but differ considerably in different classes, not only as to their size, but also in form. In all mammals, except those of the camel-kind, which have ever been examined in relation to this point, they are in the shape of flattened spheres, or of globules having a slight depression on the two opposite sides. They are so small as to be examined only by aid of a microscope. Of those in man, 3,500 would be required to

make a row an inch long ; and in the musk-deer they are even so minute as to require 12,000 to the inch. Small as these corpuscles or little bodies are, each one consists of three distinct parts ; the containing sack, the nucleus around which the rest seems to form, and the fluid contained within the cavity of the sack or capsule.

In passing through the small capillaries of the circulation, they are often elongated by being compressed between the sides of those minute vessels, but regain their natural shape as soon as they are free from the external pressure. The capsule is so permeable by water or other thin liquids, that, when diffused through almost any, except their natural serum, they swell out to a perfectly globular form, and sometimes burst, in which case their contents will be mingled with the surrounding menstruum. This circumstance renders it difficult to examine them in any other than their accustomed fluid ; for even the serum of a different animal re-acts injuriously upon them, entering their walls by the act called endosmose, or dissolving their containing capsule.

173. The shape of the globules is oval in birds and in all oviparous animals ; their longer diameter being, in relation to the shorter, about as one and a half to one. In some of those reptiles which breathe both air and water, these globules are so large as to be separable from their blood, by allowing the fluid parts to pass through filtering paper, and deposit them upon its upper surface. This would be impossible in warm-blooded animals, where their size is so minute

as to allow them to pass through a filter as easily as the other parts would do. In some of those reptiles which have both gills and rudimentary lungs, their size is not far from the four hundredth part of an inch in mean diameter.

174. These globules possess much vitality, and have a disposition to marshal themselves in order beside each other. This peculiarity may be seen by spreading out a drop of newly drawn blood upon a smooth surface, when these corpuseles will exhibit such an attraction towards each other as to gather together in small elusters. They also, in their natural situation, exhibit some changes of form, as if they were living animaleules, and not merely inert particles, acted upon by extraneous influences. Their diversity is such that those belonging to different species are not liable to be confounded; and when blood from one class, containing, for example, oval globules, is transfused into the veins of another whose globules are round, the shape of the oval ones soon disappears, and they conform themselves to their new locality by assuming that of compressed spheres. In states of inflammation, their vitality seems to be increased; and, when removed from the bloodvessels, they are, under such circumstances, endowed with more than usual activity. To say that they are the only part of the blood which is alive would be erroneous, as the whole of it, while circulating in the system, possesses more or less vitality. There are many of them found at all times, apparently in the process of formation, and others in that of decay, as

is indicated by their disintegrated and ragged appearance. They are, therefore, probably short-lived; one generation of them, when worn out in service, succeeded by another, possessed of renewed vitality. It is supposed that their principal office is to give a stimulus to the heart and bloodvessels, while they probably assist in elaborating the nutriment for the different tissues.

175. Colorless globules are also found in the human blood in considerable quantity, and are probably a more indispensable part of it than the red ones; for they are found in that of the lower orders, where the former are not (156). This class of globules is supposed to do more than any other part in elaborating from the albumen and other nutriment, suspended in the serum, those substances which go directly to support the various elementary tissues. In the circulation, their motion is slower than that of the red particles, and their situation nearer the sides of the vessels.

176. Fibrin is that part of the blood which is being elaborated from the contained nutriment, and is ready to be assimilated by the different parts of the solids, such as muscle membrane and the like. It may be easily separated from fresh drawn blood, by stirring it briskly with a stick before it coagulates, as it will readily adhere to it in small strings or fibres. It constitutes quite a portion of the buffy coat, seen on the surface of blood drawn from a patient in any highly inflammatory disease, and in some other peculiar states of the system.

177. About twenty-five per cent of the blood is solid matter. But this proportion is not always found, owing to circumstances before mentioned (168). That which is first drawn contains a far greater proportional part than that which is taken subsequently; and each succeeding removal increases its thinness, till by extreme depletion it will only have the appearance of bloody water, and it ceases to possess those properties which enable it to support the vital functions of the body.

178. In a system possessed of robust health, the vitality of the blood is beautifully manifested in case of wounds, where it is effused into that part where the lesion has been made; the globules and other particles arrange themselves in a certain order, as if from an instinctive power, and tracks are formed through the mass, which afterwards become arteries, veins, and capillaries. Thus a new-organized texture is formed to supply the deficiency caused by the wound. But it is hardly necessary to say, that, though this provisional structure is in many cases admirably adapted to the wants of the part, it never equals the original growth; as is evident from the appearance of a scar, compared with the natural skin or flesh.

179. The last act in the life of the blood is the coagulation. This generally takes place in from two to ten minutes after it is drawn from the body. It is owing to the presence and action of the fibrin, which has a continual disposition to assume an organized form; and, from this propensity to coagulate, it, together with the colorless part of the fluid, has been called

coagulable lymph. In assuming the clotted form, it entangles the red and other corpuscles in its meshes, and is by them carried down to the bottom of the vessel; the red globules being heavier than the other parts of the blood. If the fluid be stirred, so as to cause the fibrin to adhere to a stick, and thus be removed, the remaining parts will not coagulate at all; except that the dissolved albumen will do so, if raised to a temperature of 160° or upwards. Coagulation may be delayed in several ways, but not wholly prevented, so long as the fibrin is allowed to remain. By the blood being excluded from the air, the process is delayed, but still will take place, though more slowly. By being frozen instantly, it is delayed till after the blood is thawed, when it will take place, but not so perfectly. If, however, the vitality be destroyed completely while it remains in the system, as it would be in the case of death by lightning, or any poison which would act suddenly upon the nervous system, there would, of course, be no life left to further the process, and the blood would remain fluid.

Arterial blood, having just had its properties renewed in the highest degree, may be considered more highly endowed with the vital powers; and this it manifests by forming a firmer clot, and that in less time than would occur in venous; the firmness being due to the greater amount of fibrin which it contains, and the celerity of its coagulation to its vitality.

180. The most remarkable change, and the only one of any importance which takes place in health, is produced by its exposure to the air. This is effected in

the lungs. The blood is thrown, by the right side of the heart, through the pulmonary artery into the lungs, both in the right and left sides of the chest. The artery divides and subdivides, as it enters the lungs, till its capillary twigs terminate in small cells, very much as the minute branches of a tree terminate in leaves. In these cells the fluid does not come into actual, immediate contact with the air which is admitted into the lungs; but a membrane intervenes, which is so thin as to allow the air to impregnate the blood with its oxygen, which, in turn, gives up its carbon and some other subtle impurities to the air before it is expelled in respiration. By the absorption of oxygen, the blood is changed from a darkish-purple color to a bright scarlet. This impregnation with oxygen can be partially effected, in an artificial manner, by agitating newly drawn venous blood in a bottle previously filled with that gas, or even with atmospheric air.

181. Every time the blood goes round the circle of the system, it deposits in each point of its course that peculiar part of its nutritive materials which is in that place required. It seems to act the part of a pedlar, — starting from the heart with a complete assortment; disposing of fibrin here, red globules there, oily matter in another place, and returning to the fountain-head, or the body's emporium, for a new supply. But, unlike a worldly trader, who demands a valuable consideration for his goods, it takes up whatever is perfectly worthless, and thus, laden with a burden of impurities, patiently carries them to the

outlets of the system. By absorbing oxygen in the lungs, and parting with it among the solids, both near and remote, it virtually brings all these immovable parts into contact with the external atmosphere, and thus rendering its purifying and enlivening influences available to the most remote parts of the whole body. And this is the only manner in which it could be done, without violating the necessary laws of the animal economy.

ANALOGY OF THE BLOOD.

182. As natural blood embodies all that is to nourish, invigorate, and warm the body, so its correspondence should be that which performs these offices for the soul. This is Divine Truth and the holy principle of Charity; and these, combined, constitute that to which the blood corresponds, agreeably to the doctrine of the New Jerusalem. It is from the right reception and appropriation of the knowledges contained in the one, and the cherishing of the affections and doing the acts embodied in the other, that the spiritual man is sustained. As blood, in the aggregate, does not enter into and form part of any natural tissue of the body; so Divine Truth, or the holy principle of Charity, is not found in its purity or in the abstract in the human soul, but contains and conveys that spiritual nourishment which is needed for its normal growth.

183. This may be more clearly illustrated by an example. A person may be suffering severe mental

trials, for want of that aid which can only be given by Divine Truth in such form as will suit his peculiar situation. He is in doubt, for instance, whether it is his duty to come to the Lord's Supper. He wishes to do what is right, but finds it impossible of himself to decide what the right is, without an appeal to Divine Truth to guide him in making a right decision. The Word is this truth ; and from this he selects such information respecting the duty of partaking of that sacrament, and the requirements of those who would do so, as sustains him in his spiritual efforts to do his own duty, without presuming beyond the bounds of holy order. He does not find the nourishment contained in this Divine Truth already selected and prepared to enter his moral organization ; but the nutrient materials are all there, and the individual tissues of his soul must select from the flowing current what is suited to its local wants.

Again, a Christian may feel embarrassed by worldly cares, and, from moral weakness, become weary of well-doing. He knows his duty, and sees the necessity of discharging it, but has not energy enough to do so ; or, " while he would do good, evil is present with him." He sees the world around him famishing, in want of those stores which he might be the means of dispensing, but finds himself so entangled by earthly cares, or lulled by worldly pleasures, as to be incapable of coming to their assistance ; he kneels at the private altar to implore Divine aid ; and, devoutly using that prayer which the Lord taught His disciples, he feels his soul refreshed, — the holy Principle of Charity

seems to flow into his veins from a higher Source, and he is animated again to fulfil the high and holy objects of his being.

184. We have seen (168) that the blood of those who live on solid food, and labor hard, is thicker, redder, stronger, and warmer than in those of sedentary habits, and who make much use of liquid food. So those who endeavor to live the life of good, and are active in the works of charity, are evidently able to go through more Christian exertion, have more moral energy in their habits, and are far warmer in their good affections, than those of an opposite character.

185. It is worthy of remark, that the red globules, found in the higher orders of animals, are, in a great degree, in the likeness of the sun (172), which may be considered the proximate origin of natural things; for the sun is to the material world what the Divine Being is to the spiritual. "That the blood is red, is from the correspondence of the heart and the blood with love and its affections; for, in the spiritual world, there are colors of every kind. The red and the white colors are their fundamental ones, and the rest derive their varieties from them and their opposites, which are a dark-fiery and a black: the red color there corresponds to love, and the white corresponds to wisdom. That the red corresponds to love, is because it derives its origin from the fire of the sun there; and that the white corresponds to wisdom, is because it derives its origin from the light of the sun there; and, because there is a correspondence of love

with the heart, the blood cannot but be red, and indicate its origin." *

As we descend in the animal scale, the red color is not found; and the blood, instead of being warm, is cold, or nearly so. So in spiritual states, where men possess little genuine virtue, their spiritual knowledges are so little under the influence of the holy principle of charity, that all their ultimate acts are devoid of that genial warmth which characterizes the higher states of regenerate life. Their deeds of duty are not discharged with that fervor which emanates from the life's love; and, like cold-blooded animals, they are unable to make any long-continued exertion. Though they may be conscientious in a good degree, and endeavor to lead a moral life, there is something compulsory in all their virtuous acts, quite different from the hearty good-will of voluntary service.

186. The nourishment brought to the soul by truth and charity cannot remain as an inert substance, but must be constantly descending into more ultimate or external states, which are generally the ordinary duties of life: and these holy principles, after having given us day by day our daily bread, must be returned, by our daily devotions, to the Fountain of Truth; be renewed at the spiritual Heart of the universe; and then, while divested of earthly adulterations, and vivified or oxygenated by the Divine atmosphere, they will circulate again through the mental arteries of the spiritual man, and strengthen us to pursue the path of religious life. These principles, therefore, form a com-

* Divine Love and Wisdom, n. 380.

munication between the soul, in all its minute motives and affections, and the very air of heaven (181); and, by passing to and from it, bring it into contact with the Origin of life, and there renew its vital powers.

In the social man, there is a similar correspondence, but varying according to the nature of the subject. Were man in quite an isolated state, his moral and intellectual progression would be comparatively slow; but, in highly civilized communities, there are always mediums of communication through the different parts. One of the most prominent of these is the press, which brings the more remote members of society into mental contact with the more central and enlightened portions. In a state of true order, truth and charity flow through the columns of papers and magazines, to the very capillary extremities of society, improving the moral and social condition of the world.

CIRCULATION AND RESPIRATION.

187. Something has already been said respecting both the circulation and respiration in the chapters on Digestion and the Blood; but a more detailed account of each will be necessary, and require a separate chapter to come to any thing like a fair knowledge of the subject.

A circulation in some respects analogous to that in man exists throughout the animal and vegetable

kingdoms ; and, even in the natural laws of the whole earth, there is something similar. Thus, for example, water, which is the pervading fluid of the globe, has the ocean for a central reservoir, from which it ascends by water-spouts, by fog, and by insensible evaporation. This is diffused through the atmosphere or suspended in the form of clouds, is carried by the wind far inland, descends in the form of snow and rain, or condenses in that of dew, and refreshes the surface of the ground with moisture, which penetrates sometimes to a considerable depth. Having performed this office, the water collects in rivulets, brooks, and rivers, and returns again to the ocean. Without this arrangement, the atmosphere would become loaded with impurities, the surface of the ground would become dry and parched, and nearly all animated nature would perish.

188. In vegetables there is a regular circulation ; conveying not only the necessary moisture, but also the nourishment for their growth, to the various ramifications. This is simple, but perfectly adapted to their necessities. The fluid, containing the nutrient particles derived from the earth, enters the minute radicles by a process of insoaking, called endosmose, ascends through pores between the longitudinal fibres, enters the leaves, where it is exposed to the influence of the air, from which it absorbs oxygen and carbon to perfect the elaboration of the sap ; then descends or passes to those parts where the growth of the tree or plant is taking place, and becomes organized with the previous structure or as a deposit upon it.

189. In many of the lower animals, the circulating fluid, which is colorless, comes in contact with the air at the surface of the body, which is soft, porous, or otherwise permeable to the atmosphere or other surrounding medium. Here it readily absorbs oxygen and gives up its impurities, and is thus enabled to support the vital actions. In many of these, there is no central propelling organ similar to the heart; but the flux and reflux of the blood to the surface is so readily performed by the influence of the vital affinities, as to stand in need of no special apparatus. But, as we ascend the scale of being, we find the circulatory system growing gradually more complex, to meet the more complicated exigencies of the animal.

190. The heart is the centre of the circulation in man, and the principal moving power in effecting it. Its muscular strength is great, but has not till quite recently been accurately ascertained; some supposing formerly that it exerted a force upon the fluid contained in its cavities equal to several thousand pounds, while others considered it to amount to but a few ounces. But, by the aid of an instrument (called a *hæmadynamometer*), which measures the force of a column of blood in a large artery soon after it is thrown through it by the contraction of the ventricle, it has been definitely calculated to propel the blood through the artery called the aorta, with a force equal to a little more than four pounds. But, in forcing a jet of blood through so small an orifice, the walls of the heart, having a much more extended surface, re-

quire to overcome a resistance of upwards of twelve pounds.

191. The heart's propulsive influence upon the blood is less in proportion to the space it has passed along the arteries, but decreases so gradually that its power is even felt to some extent in the veins. At each contraction of its muscular walls, a jet of blood is thrown, both into the lungs, through the pulmonary artery, and into the system at large, through the aorta and its numerous subdivisions. This causes a slight dilatation of the coats of the arteries, and, raising them a little from their situation, causes the peculiar beat called the pulse: this immediately follows the contraction of the ventricles in the parts near the heart; but a space of time nearly equal to a quarter of a second elapses before the beat is felt in the farthest extremities. The heart is susceptible of different stimuli; but the proper and most natural stimulus is blood within its cavities. Having emptied itself, it dilates with some force; so that, if it were compressed moderately by the hand, it would expand itself so as to open the hand with considerable power: by this action it exerts a kind of suction upon the returning blood in the veins, thus allowing them to be acted upon by atmospheric pressure, which here aids the circulation.

192. The left ventricle, at each pulsation, throws from its cavity a little more than two ounces of blood. This, being repeated about seventy times in a minute, would show that about nine pounds is renewed, by passing through the heart in that space of time, which

is about as much as is in active circulation in the body at any one time ; though, if every drop could be drained from all the tissues, it would amount to three times that quantity. But a great part is passing very slowly through vessels of such extreme minuteness as to appear to be diffused through the very substance of the tissues ; and this portion, of course, is not renewed but once in many minutes, which much reduces the average frequency of general change.

193. The arteries assist the movement of the blood through their cavities ; and this motive power is greater as their diameter grows less, till, in those minute vessels called capillaries, they constitute the principal moving agents. Their action is not quite mechanical ; for they do not alternately contract and expand, nor manifest any vermicular motion ; but it seems to be almost wholly by a kind of vital affinity between the inner walls and the circulating fluid. In this case there must be a reciprocal action, and doubtless much is owing to the vitality and oxygenated state of the blood itself : indeed this has been rendered almost certain by a series of experiments upon the transmission of arterial and venous blood.

194. The arterics, after they leave the main trunk, continue to subdivide, to supply all parts, till they become so minute as to be imperceptible to the naked eye ; when they form a delicate network, in which the capillary circulation is carried on. Here they terminate in imperceptible twigs, which inosculate with, and bend round into, veins but little larger than themselves. In this manner an artery will continue to be

subdivided to such an extent, that, though at first it might have been no larger than a quill, it will give rise to several hundred branches. The united calibre of these will be a little more than that of the main vessel from which they originated; and consequently the blood will pass less rapidly through them than it did through the original trunk. It is in the capillary circulation that the process of nutrition takes place, and these little vessels seem to be the "operatives" in the animal economy. The blood here undergoes an entire change. It parts with its oxygen, and thereby loses its bright scarlet color; and, giving up its nutritious materials to the surrounding tissues, loses in some degree its vitality. It also takes up the carbonaceous and effete parts it meets with, and acquires a dark purple hue. It is now called venous blood, and requires to have all its vital properties restored, and its acquired impurities got rid of, to be of any further use in the system.

195. The minute veins now take their rise in the very substance of the various tissues, and mostly from those arteries which are smaller than the finest hairs. They communicate freely with each other, and in almost every possible manner, — at obtuse, right, or acute angles; and, often approximating each other sidewise, freely mingle their contained fluid. These communications, called inosculations, are less frequent as the veins grow larger, but still are found in most parts of their course; and by this arrangement the different contiguous veins can sometimes discharge each other's duties.

The aggregate capacity of the veins is considerably greater than that of the arteries, and the transmission of the blood through them proportionately slower.

196. A peculiarity not met with in the arteries occurs in most of the veins, and assists materially in the movement of the blood. This is the provision of valves, formed by a semilunar flap on their inner surface. These valves all point towards the centre of the circulation ; and, while they offer no impediment to the passage of the venous blood towards the heart, they prevent its reflux in the opposite direction. The venous blood is so sluggish, and has so little vital affinity, that it is quite passively acted upon by extraneous influences. The veins also have little positive action upon it, which renders these valves highly serviceable, if not absolutely indispensable, in sustaining the column of blood, while pressed upon, as it often is, by the action of the muscles near it ; and forcing it forwards at every movement of the body, — even that caused by respiration exerting some influence.

Thus, while the arterial circulation is caused principally by the strong pump-like action of the ventricles of the heart, the venous is assisted by the passive pump-like action of these thousands of little valves. They can easily be seen in any of the superficial veins, when in a turgid state ; for they appear like knots or bunches in different parts of their course.

197. As the venous branches approach the heart, they unite in the *cava*, a large vein situated in the upper part of the chest, into which the nutritious

fluid furnished and elaborated by the digestive process (141) is poured, just before the venous blood is emptied into the right auricle.

198. Quite a large appendage to the general circulation exists in the offset of vessels which go to the liver. These arise from the capillaries of the intestines, which unite into larger veins as they advance, till they all join in one, called the *vena portæ*, which takes upon itself much the character of an artery; dividing into smaller branches in the substance of the liver, and terminating in a distinct set of capillary vessels, from which other capillaries are to arise, and convey the blood from the liver to the heart. These vessels are destitute of valves, allowing the free flux and reflux of the blood in and near the liver, at certain periods of the digestive process, when such freedom appears to be quite necessary. These valves also are not found in the abdominal or pulmonary circulation, where the effect of muscular action, of course, would be felt but slightly, if at all.

199. The passage of the blood to and from the lungs has already been noticed (180), and the change thus produced spoken of. The circulation may thus be seen to be double; one part going to and from all parts of the system, and hence called the systemic, and the other going to and from the lungs, and called the pulmonary. Between these two circles the heart is placed; and to each circle, one portion, totally distinct from the other, is devoted; so that the heart is in all respects a double organ, both as to its anatomical structure (being in the adult entirely separated by a

partition), and also as to its functions, one part transmitting venous, and the other arterial blood.

200. The heart is situated in the most secure part of the body, being encircled by the ribs on each side, by the spine behind, and the breastbone before; so that no foreign influence shall be likely to disturb functions which are of such vital importance to the animal economy. The arteries, too, are generally deeply seated and protected, either by being within some cavity, whose walls are in a great degree secure, or by running along near the bones, and choosing that side of them which will be least liable to injury. The more important veins are also well protected; but the smaller ones which return the blood from the head and extremities are comparatively superficial.

201. Although the heart is constantly transmitting blood through its cavities, it appropriates none of it, in passing, to its own use; but an artery called the *coronary* is given off from a larger trunk, and, surrounding the organ like a chaplet or crown, sends twigs to nourish its different parts; and a corresponding vein carries back the venous blood to the circulation centre. The arteries and veins also, subject to the same law, are supplied with minute arteries and veins for their nourishment and preservation, called *vasa vasorum*.

202. There are many causes which modify the circulation. It is increased in rapidity by any thing which exhilarates the spirits and excites the physical energies, and diminished by the depressing passions or emotions. Under the influence of hope, joy, or

anger, the pulsations succeed each other with rapidity, the blood flows freely through the vessels, even the capillaries are unusually active, and the whole system feels elastic, from the highly oxygenated and vital state of the circulating fluid. The opposite takes place under the depressing effects of fear, despair, sorrow, or melancholy; and the diminished circulation is manifested by the slow and feeble pulse, the sunken features, and paleness of the skin.

203. A rush of blood to any particular part is caused by any local injury or a state of inflammation, and to the face from the feeling of shame or bashfulness, as in blushing. In effecting these changes from the ordinary course, the heart and larger arteries take little or no part; but they result from the action of the capillaries and nerves.

204. The exertion of any one part more than another causes a greater amount of blood to be distributed to that part, to supply it with the materials which may be necessary to support its increased activity. Also, any temporary growth or enlargement of an organ will meet with a corresponding supply of blood. Thus, the womb, during pregnancy, receives more than three times the amount which it possessed under ordinary circumstances; and its bloodvessels are enlarged to a corresponding degree to meet the greater service.

205. The respiration in the lowest grades of life is effected without the aid of lungs, though some provision is made by which their blood may be changed by the influence of the gases contained in the air or

water. This provision is different in the various tribes; some having soft, porous skins, through which the gases may pass and repass; some having minute tubes disposed over the surface, and ramifying through the interior of their systems; others having internal air-sacs, around which capillary vessels are situated; while fishes, which are much higher in the scale, have a much more ample provision in their gills, which, being constantly washed by a current of water, expose the blood to the oxygen which is always to be found in it.

206. But the lungs of the mammalia and birds furnish the most perfect facilities for refreshing and purifying the blood which is to be found in nature. They consist of large air-tubes, called the *bronchia*, which lead from the external air into the substance of the organ. The lungs, taken as a whole, may be considered as a large gland for excreting certain gaseous substances, which, if left in the system, would prove highly injurious and ultimately fatal. Their structure is extremely porous, so as to admit both the blood and air into their most remote parts. They not only allow them there to act upon each other, but seem to exert a positive influence in bringing about the desired changes. Their principal office is to cause the carbon which predominates in venous blood to be excreted, and a proportion of oxygen to combine with it instead, and render it arterial. It is neither desirable nor possible to remove any more than a small portion of carbon from the blood (for that which is most highly arterialized consists of about one-half carbon), but to

take away the excess which has been accumulated in the systemic circulation.

207. It has also been recently ascertained by experiment, that nitrogen and hydrogen are excreted, even though the same kind of gases be immediately absorbed from the atmosphere. The fluids of the body require a constant change; those that have once or twice gone the rounds being no longer suited to the vital demands. Also, when the digestive process has been imperfectly performed, there are deleterious gases which must be thrown out with the breath, giving it a foulness which is often very offensive.

A considerable quantity of aqueous vapor is exhaled, amounting generally to what would equal a pint of water in a day. Every one sees this in cold weather; for the vapor in the breath condenses when it comes in contact with the air or any other cold substance, forming a visible cloud or drops of water.

208. In order that the atmosphere may give to the blood a florid color, which depends chiefly upon the exchange of carbon for oxygen, that fluid should contain some salt, such as muriate of soda (common salt) or nitre, as the presence of the salt in solution causes a strong affinity for oxygen. Nitre has a similar effect on the animal fluids, even where there is no vital action, as is seen by the bright red color it imparts to meat which is impregnated with it.

209. The human lungs perfectly fill that part of the cavity of the chest which is not occupied by the heart and its appendages; and this during the whole period of life, unless air be admitted through between

the external walls of the chest and the lungs, as sometimes occurs from a wound or other opening; in which case the lung collapses, and a vacancy is left between it and the ribs.

The action of breathing is, in its mechanical relation, precisely like that of a common bellows, if the valve were closed. The cavity of the chest is enlarged by the depression of the diaphragm and the elevation of the ribs, and the air rushes in through the mouth or nose to supply the vacuum which would be caused by that enlargement; and, when the ribs are depressed and the diaphragm rises again, the air is expelled from the lungs, as if by a foreign power. The chest is lined by a glossy, moist membrane, called the pleura, which is reflected over the whole surface of the lungs, and causes them to slide with the most perfect ease, in the alternate movements which are constantly occurring. As the chest expands and contracts, the lungs are quite passively acted upon, and would seem to have no power of motion; but the smaller bronchial tubes and the air-cells have within themselves a moderate contractile power, which they probably exert to some degree in furthering the changes produced by respiration. Still, if they exert much agency (as occurs in asthma), they impede that ingress and egress of the air which is naturally so easy.

No external power can so perfectly fill the lungs with air as is caused by the natural inspiration. For, if air be forced in by bellows or any similar apparatus, as in artificial respiration, it will not pass into

the most remote or minute vessels, and consequently much of the lung will not be expanded ; and, by compressing the sides forcibly, the air thus forced in may be almost entirely forced out ; but any attempt to force out the air received in natural breathing would be vain.

210. As oxygen has always been found indispensable to life, it has been attempted by experimenters to support the vital action by the breathing of this gas, uncombined with the other ingredients of the atmosphere. They were led to this by the fact, that, whatever other combination of gases were used, the life of warm-blooded animals would be sustained for but a very short time, and even the lowest orders would all die without it, though they could forego its use for a longer period. Hopes were entertained that its use might be serviceable to consumptive patients, whose lungs could not admit sufficient air to produce the desired change in their blood. But the use of oxygen, when uncombined with the other elements of the atmosphere, produced the effect of a poison. The first effect of it was favorable. The pulse became quicker and fuller, the complexion grew more florid, and the expression more animated. All the vital actions were increased for a time, and the whole system was exhilarated. But, after this temporary amendment, a stupor or swooning supervened ; and this was shortly succeeded by death. In animals subjected to this experiment, the whole body seemed to be filled with arterial blood, and the veins exhibited nearly as scarlet a color as the arteries.

211. The result of all the inquiries and investigations of the most enlightened scientific men seems to be, that common atmospheric air is best suited to support life for the greatest length of time, and with the most perfect uniformity. Carbonic acid, hydrogen, and nitrogen, are each absorbed by the fluids of the body in a small degree, and serve the still further purpose of rightly diluting the oxygen, to adapt it to the demands of the animal economy.

212. But there are many gases which always act as poisons. Some of these, as sulphuretted hydrogen, arise from the decomposition of animal substances; and, when mingled with the atmosphere to any great extent, render it fatal to those who are obliged to breathe it. Others arise from chemical changes, which are going on among mineral substances; while others are the direct product of poisonous plants, during their growth and decay.

213. If the blood has not passed through the salutary changes effected by the air, it ceases to present the accustomed stimulus to the heart, which consequently becomes overloaded in one of its ventricles, and thus presents a material obstacle to its own movement. But the principal difficulty to the circulation takes place in the capillaries, which instinctively refuse to transmit a fluid which does not gratify their wishes nor supply their demands.

ANALOGY OF CIRCULATION AND RESPIRATION.

214. As the heart and lungs are the centre of the circulation and respiration, their correspondence, *as such*, must be well understood. When spoken of in reference to their action upon the blood, in receiving and propelling it through the ultimate parts of the body, the correspondence of the heart is to love in the will (150); and the lungs, to faith in the understanding. When taken in a higher sense, as the purifying centre, the heart corresponds to celestial, and the lungs to spiritual principles,—both having a Divine origin. But, in a wider sense, they correspond to the celestial and spiritual kingdoms, or the celestial and spiritual heavens, where all that is good and true in man originates. Their location in the natural body is, from this cause, central, and protected from external violence. Consequently, in the soul, they are in the most interior recesses, to give life to the most external motions, where the soul is in an orderly state; and, as the heart is even more interior and central than the lungs, so celestial things should be more interior than spiritual; or man should live more from the love of good than merely under the more compulsive power or influence of faith.

215. As nutrition takes place in the capillary circulation (194), so it is in the more ultimate acts that spiritual life advances. To be deeply indoctrinated in the most sublime truths of the church,—to meditate on subjects of a celestial nature, is, to be sure,

of high importance to the Christian; but, if the affections and the knowledge thus improved do not readily permeate into the minute affairs of life, and there produce real acts of charity, there can be no spiritual growth. For the natural capillary circulation is dependent, not only on the right state of the fluid they transmit, but also on the outward exertion of the part. Thus their action is so much increased in the arms of the blacksmith, the legs of the pedestrian, and the brain of the close student, that those parts grow more than others, according to their respective demands, and enable them to discharge their offices more effectually. But, where there is a deficiency of the external act, the reverse takes place. Some, who are quite ready to speak of their pious feelings and their spiritual delights, are found to be indolent, petulant, or fraudulent, when they come down to the every-day business of life. With such, there may be inflammatory swelling, but no healthy, regular growth.

Throughout the system, no part works for itself. The heart never absorbs a drop of blood from its own cavities (201), but is dependent upon the coronary artery for its necessary supply. Love in the will cannot feast upon its own stores, — cannot feed upon the holy principle of charity in the abstract, — but must be nourished by it, after it has gone forth into or towards more social duties. It is perfectly useless for love in the will to lay up within itself the purest principles, if its effort be not immediately to diffuse them in accordance with the general social demands.

Nor is it sufficient to submit them to the enlivening influence of faith in the understanding: they must go further, or perish. "Faith, without works, is dead, being alone. Yea, a man may say, thou hast faith, and I have works: show me thy faith without thy works, and I will show thee my faith by my works." If we see the body supplied with the vital fluid in all parts, we are certain the action of the heart is going on; but, if there be a general paleness and coldness in the surface and extremities, we have just reason to fear that its vital motions have ceased. It is easy to draw the analogy. It is plain to any one of common perceptions, that something more vital than the cold outline of faith, be that faith ever so symmetrical, is required in the regenerate soul.

216. As life is sustained in the lower orders of animals without lungs (205), we may hope that many who live a life of obedience to their teachers and supposed superiors, without exercising faith in their understandings, or even consulting the rational principle, may receive influx from heavenly sources, sufficient to vivify the principles of charity within them, and prepare them for salvation. In many parts of the world, this class is numerous, where the mass of the community are kept in ignorance, and controlled, but not enlightened, by the clergy; and it is of the Divine Providence that a spirit of literal obedience, analogous to a cutaneous respiration, is provided to keep the spark of spiritual life from being wholly extinguished.

217. Faith in the understanding is of such a

nature, that, if it has once been *voluntarily* filled with celestial life from the Lord, it can never be wholly freed from it. But the Divine atmosphere has not this permanent influence when driven into the lungs (209) by any other than a voluntary respiration.—There are few whose experience is so limited as not to show them that this is true. A degree of apparent or external reception will often be effected through the agency of cogent arguments or temporary trials; which, not finding any thing congenial in the life's love, is only operative while that agency is exerted which first produced the apparent effect. Still, it should be the aim of all to effect this reception to any possible degree; and, as *artificial* is often followed by *natural* respiration, so there may always be a hope, as long as there is the slightest symptom of spiritual vitality, that, if faith in the understanding be once made to expand, a voluntary reception will follow, and save the individual from spiritual death. And this is one of the most prominent providential ends in the many trials which continually beset man, in the shape of losses of friends, honor, or property, and the varied catalogue of mental and bodily pains. Of themselves, they are apparently at variance with the love which is always emanating from the Lord; but, in their real or intended effect, they are full of heavenly mercy.

218. As the presence of salt is indispensable (208) to the changes in the blood, so the affection of truth (to which salt corresponds) is indispensable in the preparation of Divine Truth and the holy principle of

Charity for interior reception and circulation in the soul. Our Saviour called his disciples the salt of the earth; for they represented the affection of truth, in all its forms, in the church. Something analogous to the affections, so represented, must be found in man (who is a church in the least form), in order that his life should become really spiritual. Then will be effected those changes in the vital fluid of his soul, which will give true life to all his acts, however ultimate, and render him internally, as well as externally, good.

219. We have seen, that the most important agent in giving new life to the blood is oxygen. It would be well, therefore, to study its correspondence. As Swedenborg has not informed us what this is, we may not arrive at an accurate knowledge of it, and can only safely approach its meaning by a course of analogy. Nothing seems to fill its correspondent office so well as devotional piety. As the absorption of oxygen gives warmth to the body, so piety warms the affections of the soul; as oxygen invigorates and purifies the blood, so piety serves to purify the affections, and fill them with life. "Piety without charity avails nothing, but joined to charity leads to every good:" * so oxygen is only efficient when brought in contact with the blood in the most intimate manner. All our acts of life, to be done in the warmth of spiritual life, should be done in a devotional and pious spirit. A stoic may submit to the vicissitudes he meets with, without a murmur; but such submission is devoid of

* A. C., n. 8252 and 8253.

that fervor which is felt by the pious Christian under similar circumstances.

220. But even this vital principle may be in excess; and, when it is, its effects will be similar, in reference to things of religion, to that of the breathing of oxygen (when not mixed with the other constituents of the air) upon the vital actions of the natural body. A devotional piety does not directly lead to the ultimate social duties, but rather to those pertaining more exclusively to religion. Under its sole influence, individuals and societies are disposed to devote an unusual portion of time and attention to religious meetings, fasts, and such other observances as are quite unconnected with the world. The life of the hermit is one of devotional piety; but still it is one which is not in the least degree useful to mankind; and it is quite absurd to suppose such a mode of existence will prepare the subject of it for the social happiness which we now look for in another life. The church of Rome was doubtlessly influenced, in its primitive state, by a spirit of piety, when its early fathers instituted the numerous fasts and holidays for which it is noted. By this they strove to increase its spirituality, and win the minds of its members from the world, and cause their thoughts and affections to be placed on heavenly things. But, though they quickened the vital actions for a time, the want of any life in those observances now, shows that in some part there must have been a radical defect. And, in the religious excitements of the present day, we witness the spiritual deadliness which supervenes upon those

overwrought states of piety which burst forth in the volcanic heat of revivals.

221. As the atmospheric air, with all its diluents, is found, by the result of every inquiry, to be best adapted to the wants of the natural blood; so, in its analogy or correspondence, we shall find no spiritual atmosphere of human origin so well calculated to vivify our inward principles in a regular and permanent manner, as that which is already provided for us in the social duties and enjoyments of life, when rightly understood, rightly discharged, and temperately used. While many pious men, in a well-meant but ill-directed zeal, have banished from Christian toleration amusements, social enjoyments, honest gains, scientific studies when not immediately connected with religion, and many of the varied recreations of common life, as the nitrogen and carbonic acid which might clog the lungs of their followers, and produce too much torpor in their systems, and substituted in their place the exclusive oxygen of piety and devotion, they have only deranged the harmony of religion by fitful impulses, and broken up that happy arrangement which previously existed. Though it is unquestionably true, that, like the analogous effect of pure oxygen, it increases the vital functions for a short time, yet the internal or spiritual constitution of man is such, that so exclusive a devotion to piety, uncombined with the duties and recreations of charity, must be as short-lived and deleterious as is the inhalation of the vital gas by the lungs.

222. Still more injurious has been the tendency of

the opposite efforts of a more pervading class of the community to dispense with the vital piety intended for their reception ; who, immersing themselves in the deep caverns and bogs of sensuality, and breathing too much of the mephitic gases there prevailing, exhibit, at best, but the torpifying effects of a reptile circulation ; unable to rise above the things of time and sense, or manifest any vital warmth in what relates to a divine life ; and often allow every spark of religion to be extinguished by their sensual habits.

There is a time to weep, and a time to laugh ; a time to mourn, and a time to dance.

To every thing there is a season, and a time to every purpose under the sun.

NUTRITION.

223. By the process of digestion, the food which has been taken into the system is converted into a substance like the white of an egg, called albumen, which becomes one of the constituents of the blood ; and is that part, at the expense of which the various tissues are principally nourished. However various may have been the food which has been eaten, the digestive process reduces the nutritive part of it to this substance ; and those articles of diet which are incapable of yielding a sensible portion of it are found inadequate to the support of life for any length of

time. But, though this substance affords the nourishment for the tissues, it is not appropriated by many of them in its existing state, and becomes organized by none without passing previously through a state of change. It is, however, found in some parts, as, for example, in the fluid about the joints called *synovial*; and, in those cases where it is met with, it must be considered, not as an organized substance, like muscle or skin, but as a kind of foreign matter, held in its situation, for mechanical or other purposes, by the surrounding tissues. As it becomes more organizable, and exhibits more vital properties, it is called *fibrin*.

224. This is the same, as to chemical composition, as albumen; but, having become more highly vitalized, its qualities are entirely changed in relation to the living tissues, for whose nutrition it is now prepared. It is to the fibrin that the coagulation of the blood (179) is due; and it is, in a great measure, owing to its vitality being increased by the absorption of oxygen in the lungs that the clot of arterial possesses greater firmness than that of venous blood. It has so strong a propensity to take upon itself a structural form, that, after being removed from its natural situation in the bloodvessels, it will arrange itself into fibrils and meshes, as may be seen by a minute examination of the clot. Though fibrin readily coagulates, and seems prone to assume the solid form, it exists in the blood, and also in the elaborated chyle and lymph, in a perfectly soluble state; and it is from this state it is taken up and organized by the various living solids in different parts of the body.

225. The first of all the forms of life, whether vegetable or animal, is that of cells ; and there are few of the tissues which do not present to the microscope traces of the cells from which they originated. These cells are minute sacs, having a nucleus around which they seem to have formed, and contain often within themselves the germs of two or more cells ; thus providing for their extension very much as occurs in the provision for growth and multiplication in many forms of vegetable life ; as, for instance, in the tuberous classes.

In the first formation of the animal, the primitive cell is furnished by the male parent ; and, nourishment being provided by the mother, new cells are developed till the structure is completed. But, though the primitive cells may be alike in different species or individuals, so far as we can discern by our senses or natural means of investigation, yet there must be some peculiar inherent tendency to assume certain definite forms ; else all would grow in the same manner, or, at least, would bear no necessary resemblance to the parent.

“Existence is perpetual creation ;” and the nutrition of the various parts is a continual birth of the minute portions which constitute them. Thus the growth of the muscular tissue, which constitutes the lean flesh of animals, is caused by the birth of new cells from the fibrin which comes in contact with such part of its substance as already exists. This is the first step in the organization of the fibrin. These cells then arrange themselves in a linear direction, and,

in doing so, assume the form of the fibrils, of which muscular fibres are made up. These cells are generally so small as to require the aid of a good microscope to see them clearly: even the fibrils, which are formed by them, are not to be distinguished by the naked eye, without a painful effort.

226. Cells may originate, not only in the parent vesicle, but in the fibrin from which they are elaborated, by coming in contact with a living solid. In this fibrin they sometimes spring from minute granules, which serve as nuclei for their formation. This, however, does not fully take place in any other circumstances than where it is subjected to vital action, as occurs in the different parts of the animal body. This is seen to good advantage in the rapid secondary growth which takes place where there has been an ordinary cut. Here the coagulable lymph is effused on the cut surfaces, and in it minute granules are soon developed into cells; and these, uniting, form a membrane upon those surfaces, which constitutes the most important step in the reproduction of the lost union; for, by a regular multiplication of cells, any tissue which is required may be formed.

227. Although these cells are formed from fibrin, and always require a supply of that substance, from which they may draw the material of organized fibres; yet there are several substances, bearing no analogy to fibrin or albumen, which enter largely into the structure of some important parts. One of these is phosphate of lime. This never becomes organized, in the strict sense of the term, as an animal substance or

living solid, but is deposited in cells (much larger than the primitive cells just spoken of), formed of organized tissue. While retained in this situation, it constitutes bone; and, being mostly mineral in its nature, it forms one of the most imperishable and unchangeable parts of the system.

228. As soon as cells have been thoroughly formed from the circulating fluid, and, by the aid of the living solids, have become assimilated, they are vitalized; and, becoming a part of the tissue, soon exert an influence in the generation of other cells. In this manner the growth of parts is often carried on in a geometrical progression.

By what power the fibrin is assimilated and appropriated by the different parts, it is impossible to speak with certainty. It is known to be caused by the peculiar affinity of each structure for the nourishment adapted to itself, as found in the blood; but how it effects this, is an ultimate fact, referrible only to the laws of vitality. Still we can trace with distinctness many of the primary steps towards the completion of the assimilating process.

229. After the chyle is formed from the food in the stomach and upper intestines, it is mostly conveyed, through the lacteals, to the mesenteric glands. In these it undergoes considerable change; the chyle-globules increasing in number and perfection, and the nutritive fluid approaching nearer to the nature of albumen. After passing through these glands, it possesses nearly the same characters which it presents on its first entrance into the blood. The first object is

to destroy completely the organization which previously existed in the food, before any further progress can be made towards its assimilation in the tissues. It has been before stated, that it is reduced to the state of albumen in the blood. Now, although albumen be taken for food, it will have to pass through all those changes in the stomach, which any bland article of diet would, before it can become *that* albumen which is fit to enter the circulation ; and, if the purest albumen or fibrin were transfused or injected into the veins, it would there produce the effects of a foreign substance. It is, therefore, impossible for one animal wholly to digest another's food, so that *his* system can be nourished without the agency of his own digestive organs, although they do much towards its preparation.

230. The tissues which are formed from the fibrin are extremely various, according to the different offices they have to perform ; and several of them hold so much foreign matter in their organic cells, that the really assimilated structure constitutes but a small portion of the mass. This is the case with the bones, the nails, and the teeth. The greater part of the tissues, however, are wholly organized, and have been originally elaborated from the fibrin, of which the blood always contains a considerable amount.

231. The muscular tissue consists almost wholly of fibrin and water ; about one-sixth being fibrin, three quarters water, and the remaining twelfth made up of several substances or elements in small quantities. Though the substance of muscle is well supplied with

bloodvessels, yet, whenever it is partially destroyed, as it is in case of wounds, its loss is made up with a more imperfectly organized material, called *fibro-cellular tissue*, which possesses much strength, but no sensible amount of contractile power.

232. The nerves are formed by a series of small tubuli of cellular membrane, and containing within them a substance which is always soft, and probably nearly fluid during life; the granulated appearance of it after death being due to a kind of coagulation. Like the brain in its structure, it contains quite a large proportion of fat, which differs considerably from that which is found in other parts of the system.

233. No other tissue, or part of the body, receives so great a relative share of the nutriment furnished by the blood as the brain, in cases where there is a great amount of mental exercise; and the draft thus produced upon the alimentive materials is such, that it is a rare occurrence for a person of a restless or energetic mind to have any surplus of fat deposited in the usual reservoirs, however luxuriously he may live; but, in those of indolent habits, the reverse is proverbial.

234. Bones are nourished, as the softer parts are, by the agency of the vascular system; but the cells which constitute the animal portion are filled with a deposition of phosphate of lime, which, being an earthy substance, requires little or no renewal; and, consequently, the relative nourishment is less than is necessary for those tissues which are more highly animalized. Still, what nutriment they *do* require is as

indispensable to their health and durability as the proportionately greater share is to the other more vital parts; and, if the vessels of supply should be cut off, the bone would exfoliate, or partially die, and a very diseased state be produced.

235. In the process of growth or renewal, the work is almost wholly done by the development and subsequent agency of cells, each of which possesses some degree of independent life, and enters upon the work of reproduction soon after it becomes a part of a living solid. This tendency is a healthy one, and that by which the process of nutrition is rendered complete; but it often exhibits greater energy in unhealthy growths, such as those of a cancerous and fungoid description, than in those of a normal kind.

236. "Each part of the organism has an individual life of its own, whilst contributing to uphold the general life of the entire being. This life or state of vital action depends upon the due performance of all the functions of all the subordinate parts, which are closely connected together. The lowest classes of organized beings are made up of repetitions of the same elements; and each part, therefore, can perform its functions, in a great degree, independently of the rest. But, in ascending the scale, we find that the individual lives of the cells become gradually merged in the general lives of the structure; for they gradually become more and more different in function, and therefore more and more dependent on each other for their means of support; so that the activity of all is necessary for the maintenance of any one. Hence the

interruption of the function of any important organ is followed by the death of the whole structure, because it interferes with the elaboration, circulation, or purification of that nutritious fluid which supplies the pabulum for the growth and reproduction of the individual cells.

“ But *their* lives may be prolonged for a greater or less duration, after the suspension of the regular series of their combined actions ; but, if the function of the part have no immediate relation to the indispensable actions just adverted to, it may cease without affecting them.” *

237. The demand for nourishment is greater, and the changes of the different structures more rapid, in the periods of youth and manhood, than in those of old age. The whole individual, also, is more active in his movements, and seems to perform every function of life with more sprightliness and energy. There is, too, more firmness and dryness in the cell-life of the aged ; the bones become more calcareous, and have far less animal matter in them, which makes them brittle, and, consequently, easily fractured, and with difficulty restored when they are so.

238. In early life, particularly, there is a quick transition in the component parts of all the tissues. The development, growth, and death of individual cells is continual. This constitutes the process of renewal before spoken of (5). But many cells begin to grow, which never become part of a living solid, being probably designed more perfectly to elaborate the lymph

* Carpenter's Human Physiology.

or fibrin by their temporary agency, and thus prepare it to become more highly vitalized than it could be immediately from the state in which it was found in the blood. These temporary cells, immediately after their formation, become dissolved, and their materials are directly used in the development of others.

239. It is seldom that every part is nourished equally; but each receives according to its amount of functional activity. When the muscles of the arm are strenuously and uniformly exerted, the bloodvessels, entering and traversing them, become enlarged, and furnish a liberal supply of nourishment; while some other part, being inert, may receive but a very small amount. This supply is partly appropriated by the part itself, causing the limb to grow sometimes inordinately; but the greater part is consumed in the reproduction of those cells which are worn out by exertion; for the renewal of tissues is mostly proportionate to their functional activity.

240. To maintain a healthful balance of the nutritive process, it is necessary that no one order of tissues should be exclusively exercised. If the muscular apparatus be taxed by continual exercise, or as continual as it is capable of, there will be a deficiency in the development and activity of the mental powers; and, though the *bodily* health is not likely to suffer by the arrangement, there will be a dulness and stupidity in the intellect, which will not indicate “a *sound mind* in a sound body.”

On the other hand, if physical culture and exercise be neglected, and the intellectual powers be

severely taxed, though the perceptions will be thereby rendered more acute, and the rational energy more highly developed, the animal functions will become languid; and, the stimulus of demand being deficient in the corporeal tissues, the nutritive process will be insufficient to carry on all the vital actions in an orderly manner.

241. There is an inherent tendency in the animal economy, particularly in the temperate and high latitudes, to digest more food in a state of health than is necessary for the immediate supply of the bodily requirements. This is more the case with those animals which are liable to need a just allowance during the winter season; for they deposit in the interstices of the body, and in the adipose cells, a large amount of fat, during the plenty which prevails in autumn, to meet the deficiency which will exist when their food is mostly covered with snow, or ceases to be produced by the earth. This is also seen, but to less extent, in the human economy; and the predisposition to corpulence, in those whose worldly circumstances are comfortable, and whose minds are at rest, is well known.

This supply of fat seems to preserve the vital organs from the influence of external cold (fat being a poor conductor of caloric), and constitutes a reservoir of nourishment to meet future liabilities. It also affords, in many parts of the body, a soft cushion upon which the tendons may slide with greater facility, and gives to the limbs that roundness, and contributes to that symmetry, which is peculiarly agreeable to the eye.

ANALOGY OF NUTRITION.

242. Albumen, I think, is not spoken of by Swedenborg; but its correspondence would probably be natural good and truth, not yet vivified by Divine influx; as this constitutes one form, and a prominent one, of the pabulum for spiritual sustenance.

All spiritual states are successive; and in one state is formed the embryo of the state next succeeding. Now, as spiritual growth or nutrition is a continuance of *regeneration*, that degree of development which is effected by one state (digestion) serves only as a preparatory one for assimilation; as albumen is preparatory for fibrin, and fibrin for the growth of cells, &c.

“In the state of infancy, when man is regenerating, spiritual things are therein with potency; for spiritual life successively comes forth from whatsoever age, as from an egg. The age of infancy is, as it were, an egg for the age of childhood, and the age of childhood is as an egg for the age of adolescence and youth, and this as an egg for adult age. Thus man is, as it were, continually born.” A. C., 4378.

“Man, when he is reborn, passes through the ages as he who is born; and the preceding state is always as an egg in respect to the subsequent one. Thus he is continually conceived and born; and this not only when he lives in the world, but also when he comes into another life to eternity; and still he cannot be further perfected than to be as an egg to those things which remain to be manifested, which are indefinite.

From this it is evident, how innumerable the things are appertaining to the regeneration of man." A. C., 4379.

Though natural good and truth, not made alive by Divine influence, cannot in that state become part of a spiritual organization, yet they are quite useful in the spiritual economy for some of the lower uses peculiar to regenerate life, and for such purpose may be retained in more spiritual affections. Still its tendency (224) is to pass by Divine agencies into a more truly vital state, when from natural it becomes spiritual, and is ultimately assimilated as such.

243. The individual constituents of the mind are not known to us, they are so minute; and it is not in our power to ascertain precisely our state of regenerative advancement. But so minute are the secret springs in the soul's machinery, that they may well be compared to the primitive cells in the formation of the bodily structures. When these integral parts of the affections are under Divine influence, there is a degree of independent life in each one, however minute. But their spiritual tendency is to come into orderly arrangement with other feelings and thoughts, and, by so doing (225), to give birth to a larger and more complex form of spiritual life. So in the social relation: though each individual within the pale of the church is a recipient of life, yet, when he is in contact with other vital parts, it is his wish to constitute a member of the religious community, and contribute to its more full and perfect development. And as space cannot be predicated of spiritual things, his living at a dis-

tance from any organized society is no impediment to his being a member of it, if there be the requisite moral nearness.

244. In the proprium of the external man, to which bone corresponds, there is much that has no spiritual life ; its cells contain much that is " of the earth," and which cannot be organized, but may be filled with so much life as to form the framework of the soul. Indeed, without this proprium or self-hood, all individuality would be lost, and nothing truly human could be erected. But, to vivify this self-hood, spiritual cells must be developed, and real life descend and permeate its substance, to give to its earthy ingredients that form, arrangement, and power of growth, which is indispensable to its being a structure.

In churches, which are men in a larger form, when they externally outlive their spirituality, that which is analogous to earthy matter predominates in all that is peculiar to them, or constitutes their proprium, and unfits them for their designed usefulness (237).

245. Spiritual assimilation is very pervading ; and like the bodily tissues, where each part strives to appropriate to its own organization those parts of the nutrient fluid which are capable of assimilation, there is a propensity in most persons to endeavor to bend the thoughts and feelings of others to those states which are most nearly allied to their own. But as all tissues are not the same, and have diverse uses to perform, so there must be a permanent diversity among men as to their thoughts, feelings, and in some measure as to their creeds. The inordinate desire

which some have to proselyte indiscriminately all who may come within the sphere of their influence is far from being a healthy one. It is not founded in the more orderly state of natural things, nor on true psychological principles, but is rather a moral cancer, in which the tendency to promote their own exclusive growth makes them invade many minds which are really more righteous than their own; like those fungous tumors sometimes seen on the human body, which, in their own morbid developments, swallow up the healthy tissues, and only causing pain and death. The endeavor, however, to appropriate all that is capable of perfect assimilation is consistent with Divine and natural order; and a serious as well as agreeable duty rests upon those whose minds are open to the light of Truth, to bring all others who are in a state to be profited by it, not only into the light of the same truth, but also to induce them to cherish the goodness which is its suitable accompaniment.

246. We have seen, that there is a great diversity in the growth and removal of the different tissues, and that this is proportioned in a great measure to their relative activity. This is no less true in respect to the changes which take place in the mind. And where there is much moral indolence, there will be little or no progressive change. But change alone does not imply improvement; for, as sudden changes in the natural subject are most frequently the result of a diseased action, and offend the eye by their monstrous deformity; so, in the spiritual subject, the change will often destroy all symmetry, giving to

the exercise of one apparent virtue an exclusive devotion, while all others lie neglected; and even some favorite vice may luxuriate within that which has the semblance of being so good, and the rapidity of its extension might be but a proof of its malignancy.

247. Peculiar dogmas sometimes spread with mushroom rapidity; but, like Jonah's gourd, they are generally of temporary duration. That a system of religion is of difficult reception, and consequently of slow progress, is no evidence of its falsity or want of foundation; for those tissues in the human body which are designed to be most durable are, as a general thing, the slowest in their growth. In fact, we may rather infer the reverse to be true; for it may well be said of a doctrine, "If it were of the world, the world would love its own;" and this we generally find to have been the case in the history of true and false religions which have heretofore existed. At the present time, it is very evident, that a new religion, to be favorably received, must either be adapted to the vitiated taste of a sensual community, or that this depraved moral taste be chastened and elevated so as to imbibe that which is pure. In the advance of truth, the great existing fact is this: one creed, in the ways of Providence, is made to prepare in some measure for another, each making some advance towards the Divine, till that which is of heavenly birth may by degrees be believed, felt, and brought down into ultimate life by mankind (238).

248. If we are to judge from analogy, we must see that no one can wholly digest another's spiritual food

(229), or take upon himself another's regeneration. For, however bland and palatable religious truths may be made by others, unless they undergo a process of internal change and reception by the individual, they can never become a vital part of him. Were it possible to transfuse the spiritual food digested by one into the soul of another, a state corresponding to violent fever would inevitably ensue.

When the blood of a healthy person has been transfused into the veins of one who has been extremely reduced by hemorrhage, with a view to prevent impending death, a high degree of feverish excitement has been the uniform result, and in most cases baffled the design of the physician. The observation of those who have had an opportunity of witnessing the effect of that state in religion which would be similar to this, will show how analogous is the case of those who believe themselves to be saved from the consequences of their sins by the sufferings of Another, independently of a practically new life in themselves. Their clapping of hands, boisterous praises, ejaculatory prayers, and elation of mind from their supposed salvation so suddenly effected, are more like the ravings of a subject of brain-fever, than the rational voice of one in whose system flows the blood of health; more like the tempest, the earthquake, and the fire, than like the still small voice, in which is the emblem of the true Divinity.

In this connection, it may readily appear how irrational must be any doctrine which teaches the efficacy of vicarious suffering. For salvation from sin is not

an external work, which can be effected by proxy, any more than man can eat or grow by proxy; and it is as much at variance with spiritual laws for the merit of one, even though that One were Divine, to save another deficient of any heavenly qualities, as it is contrary to the laws of the animal economy for the albumen of an egg to be assimilated by the vital tissues, without being previously digested in the system of which it is to become a part.

249. The more perfectly organized is any social community, the more each is dependent upon the rest. And though each member has some degree of independent power, it is merged in that of the community, in proportion to its degree of advancement in civilization (236). This renders it of the most vital importance, that, in a religious society, there should be a healthy state in all the organs and members of which it is composed. If a vital part be diseased, all the individual fibres must suffer more or less. In the more savage states of society, and in the lower or more external orders of religion, this is not so emphatically the case; as man here more nearly resembles the lower order of animals, where each member, and even cell, may have a separate existence, and give birth to a structure of its own, as is the case with many zoöphytes. This absence of individual independence, in members of a well-organized church, may at first sight seem to be a defect; and some might prefer to stand a grade lower in the scale of advancement, if, by that means, they could embody in themselves the elements of independent life. But both observation and reflec-

tion show that the defect is only apparent. The wild Indian of our forests is the most perfect specimen of an independent man: he fabricates his hunting implements, kills his game, dresses his food, tans his leather, makes his clothing, builds his wigwam, and constructs his canoe with which he navigates the lakes and rivers of the woods. He looks to no one for assistance, and is as independent of his fellow-man as any one can be; but how imperfect are the works of his hands! and how few of the comforts of life surround him! He makes no advances towards a higher degree of improvement, but remains naturally, morally, and intellectually, only what his fathers were. Should any one look for entire independence in religion, he must be content to advance as slowly and imperfectly in a moral point of view, and add little or nothing to the welfare of others. But the privilege of enjoying an opinion entirely his own will hardly balance the benefits he might have derived from an interchange of thoughts with others, besides losing the satisfaction he might have received of having contributed by that interchange to their moral wealth. In the present state of the world, however, it is impossible to form an adequate estimate of the benefit we have derived and are deriving from the moral labors of others, and of our consequent duty, in justice and common honesty, to contribute, by uniting our efforts with others, to the spiritual well-being of the community.

250. In young societies, there is a more eager demand for knowledge, and such instruction as would

correspond to nourishment (237), than in those of longer standing. They are, of course, ignorant of much that it is important for them to know ; and, like men who have never had the advantages of elementary education, they attach an undue importance to truths, which, as yet, they but imperfectly understand. As they arrive at a more fully developed state, the practical duties of their station attract more regard, and lead them to enter with more zeal upon their discharge.

In this early stage, their change of state is also more rapid. Every thing with them is formative, changing and springing forth into more perfect development. They require much spiritual nourishment to aid this development ; and, though they feel and manifest a readiness to engage in the sterner duties of life, their efforts are too often characterized by indiscretion and premature fatigue. “The spirit is willing, but the flesh is weak.” There is not that firmness and consolidation which older ones exhibit ; and, as a partial consequence of this, there are two dangers to be avoided, — a puny growth, for want of spiritual food ; and a distorted one, from any evil or false bias. There is a great amount of activity, both of thought and feeling ; and the entire aspect is buoyant and cheerful.

Another feature in young or new societies is the warmth of feeling they entertain for each other. In the first years of the Apostolic Church, the Gentiles noticed this youthful attachment, and were wont to exclaim, “Behold, how these Christians love one an-

other!" The same occurrence has been repeated in every succeeding new form of belief. How perfect is the analogy here with the correspondent period in the life of man, the experience of most of us can testify. In childhood and youth, our friendships were cordial, disinterested, and often hasty. We extended our hand with warm sincerity to every companion, told our thoughts, unbosomed our feelings, and listened with interest to the narrations of others. But time wrought a change in others and in us. Intercourse with the world taught us caution and reserve, and sometimes a cold indifference succeeded the ardent sympathies of earlier years. But these changes are not to be regarded with a sickly sentimentality, but rationally viewed as the legitimate result of causes, which, in the present state of the world, must continue to produce similar effects. And, if we have to regret the smiling friendship of former states, we may rejoice at the steady endurance and well-directed labors which happily mark their successors.

251. Goodness, of celestial origin, corresponds to fat, stored up in the system. This, in early or active regenerate states, more equally pervades the other powers, and more readily extends into the ultimates of life. But, when the summer of life is drawing to a close, the ability of the individual to expend the whole of this kind of nutriment decreases, and there is a tendency to its accumulation, producing that spiritual quietness and peace of mind which often precedes a departure to the other world. In the ordinary discharge of duty, this celestial goodness causes

the various truths which are promulgated (tendons) to become diffused (move) more easily, and serves to communicate a fairness and beauty to the spiritual man, which cannot be regarded but with delight. It has been remarked, that the features in man are more prominent and harsh than in woman; also that the museles protrude in bolder relief. This is from correspondence. For the female form is rounded and equalized by a liberal deposition of fat, as her internal qualities are softened and perfected by that goodness or kindness of heart which is one of her characteristics; while man is more distinguished for his intelligence and truth, qualities of sterner and more compulsory aspect, while there is generally a deficiency of that to which fat is analogous.

Celestial goodness preserves a warmth in the internal man, and keeps the better affections alive; as a deposit of fat preserves the natural body from the chilling effects of the external air in the cold climates. And, where men are exposed to the depressing effects of worldly thoughts and affections, the vital warmth of their religion will be soon extinguished, if they are not actuated by that goodness of heavenly, and not mortal origin, which alone can sustain them through evil report as well as good report, — support them through the gloomy winter, as well as cheer them on the return of spring.

THE FIVE SENSES.

252. It is to the possession of one or more of the senses of touch, taste, smell, sight, and hearing, that man owes his knowledge of external nature, and maintains any degree of intercourse with the material world. Were it possible for any one to exist without either of these senses, he would necessarily be an isolated being; and, though he might have some ideas of spiritual origin, he would never form any from surrounding objects.

253. It is not uncommon to meet with individuals who are deficient in one or more of the senses, who still seem to enjoy life in a limited degree, and contribute something to the happiness of others; and the benevolence of the present age is quite alive to their privations, and doing much to ameliorate their condition. And, while the descent of a new church is tending to remove the films from spiritual sight, and causing those who have ears to hear, this benevolence towards the *naturally* deaf and blind will grow still more active in bringing the principle into ultimates.

HEARING.

254. The sense of hearing is that by which the idea of sound is communicated to the mind through the ear, which is the organ specially adapted to its conveyance.

255. Sound is caused by the rapid vibrations of the air, when it has been put in motion by the impulse of some sonorous body. This vibration proceeds in all directions (but not equally), much like the spreading of the waves when a solid body is thrown into the water; the waves of the air growing less distinct as they recede from the starting-point, and, consequently, the sound becoming fainter and fainter, according to the distance it has travelled. The varieties in these vibrations are innumerable, and dependent upon the peculiarities of the different exciting agents. The tones of the human voice, a blow upon a drum, the discharge of a cannon, give each a peculiar impulse to the air, which is followed by a correspondent sound; but, though this is, in each case, dependent upon the vibrations of the conducting medium, their diversities are of so subtle a nature as almost wholly to elude our means of observation.

256. The medium of sound, though generally air, is not always so. Fish hear quickly in water, and so can man. Even solids, such as wood, and many metals, are tolerable conductors of these vibrations.

When the air is set in motion by a sounding body, it is itself capable, though in a diminished degree, of communicating a similar motion to water, or to air which is separated from it by a wall or door. Indeed, sound may be propagated through several media, but not through a vacuum.

257. When the sounding agent communicates a vibration to a stratum of air, this impels the next, and so onwards, till the effect reaches the ear, and,

penetrating the cavity of this organ, impinges upon the membrane of the tympanum, or drum of it, and thence is communicated to the lining membrane, which is liberally supplied with its peculiar nerve; and hearing is the result.

The external ear serves to collect the sounds (or receive the vibrations of the air), and transmit them, partly by resonance, and partly by conduction, into the narrow passage which leads to the cavity within the bones of the head, where the principal parts of the hearing apparatus are situated.

258. These parts consist of a middle chamber, separated from the outer passage by the membrane of the tympanum, which receives the vibrations of the air, and responds by a correspondent movement; of a chain of four small bones, which conduct the sound from the drum to the internal ear or labyrinth; and of the inner chamber, which is filled with a thin fluid, secreted by its lining membrane.

259. When the sound has been transmitted through these several parts, it affects the acoustic nerve, which is distributed upon the lining of the vestibule and cochlea; and the impression is communicated, through that nerve, to the brain, and the mind becomes cognizant of its nature and peculiarities. But, though the impression is made upon all who can hear, there is great diversity in the capabilities of different individuals to appreciate sounds. Some are notable for their quickness in hearing; others, for their discrimination of the various musical tones; and others,

for their power of hearing noises which are too faint for ordinary perceptions.

260., Education, or training, has much influence in improving the power of hearing; and it is probable that the capability of ascertaining the direction and distance of objects, by the sounds they produce, is entirely acquired by habit and cultivation. Much of the accuracy and delicacy of what is called a musical ear are to be attributed to the same source, though not in a great degree dependent upon the mere sense of hearing, but rather upon the mental powers connected with it.

SMELL.

261. The nature of the odorous particles which give rise to the sensation called smell is as yet not well ascertained. They must be imponderable; for an odorous substance will continue to send forth a strong perfume for a great length of time, without sustaining any perceptible loss of weight. They are also invisible, though recourse be had to the most powerful magnifying glasses. They can only be appreciated by the sense specially adapted to their detection.

262. It has been the generally received opinion, that extremely minute odorous particles become diffused in the surrounding medium, and, coming in contact with the Schneiderian membrane, which lines the nasal passages, or that part of it which is supplied with twigs of the olfactory nerve, communicate to the

sensorium, through this nerve, the idea of smell. Any thing which is volatile, whether solid, as musk and camphor; liquid, as the essential oils; or gaseous, as free ammonia, was supposed to be capable of exciting this sense. But water, and many other things, which are quite volatile, are free from any odor perceptible to us; while there are other substances which are strongly odorous, without being perceptibly volatile.

263. The probability is, that a peculiar sphere or emanation surrounds many of those substances which are denominated odorous, which, coming in contact with the olfactory nerve, affect it in a peculiar manner, and thus excite the sense. But, when there is any palpable loss sustained by a perfume, the former explanation would be satisfactory.

264. Man, in a civilized state, has this sense less developed or trained than the savage, and still less than many of the lower animals. The carrion birds will perceive the effluvia of their favorite food for miles, even when the effluvia could not be conveyed to them by any current of air; and the power of the dog to select the track of his master is equally surprising.

265. The nose, which contains the nerve and organ of this sense, is placed in the immediate neighborhood of the mouth, to guide in the selection of wholesome food, and also at the principal inlet to the lungs, to detect any thing in the air which might prove deleterious if inhaled. This sense, to man in the civilized state, is of the least importance of any of the senses.

SIGHT.

266. The sight takes cognizance of the rays or undulations proceeding from any luminous body. — These rays are subject to certain invariable laws, called the laws of optics; and the eye, which is the organ of sight, is a most ingenious and perfect optical instrument.

267. The rays of light, proceeding in a parallel direction, enter the transparent part of the ball of the eye, called the cornea, and, by a well-known law, converge as they pass through the humors and crystalline lens, till they come to a focus, and form an inverted image of the visual object on the retina, which is situated on the posterior concave surface of the organ.

268. The optic nerve enters the orbit through its back part, and, ramifying into numerous extremely minute branches, terminates in nervous papillæ in the retina, which receive the impression formed by the light or object transmitted to it through the ball of the eye. These papillæ are considered to be as minute as the smallest luminous object which is visible to the naked eye.

269. Perfect or clear vision depends upon the transparency of the membranes and humors of the eye, and a healthy state of the optic nerve; and it is also much influenced by a right or harmonious direction of the axes of the two organs. If the right eye be directed to one object, and the left to another,

there will be two images formed on the retina, which will serve to confuse each other, and the mind will consequently receive an indistinct idea of either. But if the eyes be single in the visual axis or direction, "the whole body will be full of light."

270. With the exception of the sense of touch, this is the most important sense to man, and one which is generally possessed in the greatest perfection; for, though two individuals cannot easily be found, whose taste, smell, touch, and hearing, are precisely equal to each other, yet the majority can see with equal clearness.

The eye, too, seems to manifest, by the variations and expressions it assumes, more of the states of the mind within than all the other features. It has, on this account, been sometimes called, with propriety, the window of the soul.

271. The ideas derived from the sight are many of them acquired by habit, and corrected by the sense of touch. For those whose sight has been restored by operations in adult age have been unable to judge of size, form, or distance, by this sense, unaided by some other, from which they had been in the habit of forming their calculations.

272. Though the sight furnishes data for many kinds of acquired judgment, yet the accuracy of those judgments does not depend upon the power of the eye as the organ of vision, but rather upon certain mental operations, which are themselves dependent upon a system of education, and biased by certain innate predilections. Thus, for example, several per-

sons may be looking at a piece of machinery, and the images of all its visible parts will be transferred to the retinæ of them all; yet one will see much more of its construction than another, because he will direct his attention to its various components; while a second will see, or rather be conscious of seeing, only those parts which are most superficial. So, in looking at the full moon, just rising, some will estimate its apparent diameter at two, and others at twenty feet.

TASTE.

273. The sense of taste is dependent, in some degree, upon that of smell; for, if the latter be wanting, or temporarily suspended (as it sometimes is in a common cold), the taste is found to be defective. Unlike the three senses already noticed, this cannot be exercised without its proper organ coming in contact with the sapid substance to be examined. In its exercise, therefore, it is most nearly allied to that of touch; of which, in many respects, it is but a modification.

274. The tongue is its most special organ; but the inner surface of the lips and the roof of the mouth contribute considerably to its perfection. In these the gustatory nerve is freely distributed, terminating in minute papillæ, particularly in the upper surface of the tongue. The salivary glands furnish a supply of moisture, which is indispensable to the function; as any perfectly dry material, coming in contact with

the tongue and palate while in a dry state, communicates to them neither flavor nor pungency.

275. It would be difficult for us to determine the natural powers of the sense of taste; for in man it is so influenced by his artificial condition, that the function exists in almost as many states as there are individuals. Much of its peculiarity, no doubt, is hereditarily derived; but much also depends upon the manner in which it has been gratified. On this account it becomes perverted in many; rendering those articles of diet and narcotic drugs agreeable, which, to the more natural taste, are extremely disgusting.

276. In the common orders of animals, it at once enables them to select those kinds of herbs or fruits which are designed for their nourishment, and to reject such as are poisonous. It also, probably, directs them, when wounded or sick, to those of a medicinal nature, which are likely to contribute to their cure. This rule, however, has exceptions among domestic animals; for sheep will greedily devour a species of laurel which often causes their death; and the horse will feed upon lobelia, to the prejudice of his health and comfort.

277. Where this sense has been frequently indulged, its gratification is attended with exquisite pleasure; and the votary is often so enslaved by it as to be led to ruin his health and destroy his usefulness, rather than withstand its allurements. But, within due limits, its gratification is followed by favorable results; contributing to the function of digestion,

and enabling man to enjoy the bounties of nature. Though often perverted to a great degree, it is seldom destroyed; but rather increases in acuteness, from the variety of its pleasures, and too often triumphs over a frame enfeebled, and a constitution shattered, by the excess of its indulgence.

TOUCH.

278. Of all the senses, the most generally diffused, and most indispensable to self-preservation, is that of touch. It is spread over the whole surface of the body, and extends, though in a less degree, to some internal parts. There is great difference, however, in the relative amount of sensation in different portions of the skin; some conveying to the mind but vague and indistinct notions, while others discern the qualities of external objects with the utmost nicety, and, through their respective nerves, transmit the impression to the brain.

279. The inner surface of the thumb and fingers of the right hand are most liberally supplied with the sensitive extremities of the nerves; and here the touch is most perfect for distinguishing the form and quality of objects, though there are many other parts which are more sensitive to the perception of heat and cold. Next to these comes the skin upon the lips, nose, face, toes, and neck; and, last of all, that on the central parts of the limbs and body.

280. A general feeling, termed *sensation*, prevails over and through every part of the system, which is

supplied with nerves of sensation ; and this includes nearly the whole. This is not, however, what is meant by the sense of touch, which, properly speaking, is a definite modification of sensation for specific purposes, as taste is a modification of the more generally diffused sense of touch. It is by the aid of this sense that we acquire the distinct ideas of form, size, hardness, smoothness, and similar tangible qualities of external things. Also, when assisted by the muscular sense, it enables us to judge of weight and resistance.

281. Like the other senses, this is capable of communicating pleasurable emotions, and those which are opposite. Thus, there is an agreeable sensation excited by passing the hand over a smooth or velvety surface, or by bringing the cheek or lips in contact with an object of affection ; while the contact of the mottled skin of the toad, or slimy body of a snail, is as peculiarly disgusting to the touch as it is repulsive in its appearance.

282. This sense is often used to correct or confirm ideas derived from the others ; and, being the most material or sensuous of any, is least of all apt to deceive in those evidences which are purely demonstrative. But the knowledge of the external world would be very limited, if the sight were not trusted to in those cases where the touch would be impracticable. The latter sense may lay the foundation for our notions of form, size, &c. ; still the sight affords so much greater facilities for appreciating an assemblage of objects at a glance, or of judging of space and extension, that

after our earliest years we seldom consult that of touch in confirmation of it.

ANALOGY OF THE SENSES.

283. Hearing corresponds to, and is the external manifestation of, obedience. A moment's reflection will show that this is not an arbitrary correspondence, but one founded upon something inherent in the nature of things. No kind of expression is more common among men than such as these: "He wont *listen* to reason," meaning he will not *obey* her voice; "If he had *hearkened* to his friends," that is, if he had *obeyed* their directions; "He closes his ears to the voice of conscience," that is, he refuses to *obey* its dictates. And expressions of a similar kind are extremely numerous.

"Ears, in the internal sense of the word, signify obedience; by reason also of the correspondence which exists between hearing and obeying, which correspondence lies hid in the very expression, *to hear*, and still more *to hearken*; the origin of this is from the other life, where they who are obedient and dutiful belong to the province of the ear." A. C., 2542.

"The spirits who correspond to the hearing, or who constitute the province of the ear, are those who are in simple obedience, namely, who do not reason whether a thing be so, but who believe that it is so because it is said to be so by others; hence they may be called obediences. That they are of such a quality is because hearing is to speech as the passive to its

active, or as he who hears a person speaking and acquiesces." A. C., 4653.

284. If the drum of the ear do not act in obedience to the impulses caused by the vibration of the air, natural hearing will not ensue from the propagation of sound. So, if there be not an inward principle of the soul vibrating in unison or harmony with the divine *aura* or influence, there can be no true internal obedience. There may be an external obedience, correspondent to the collection of the undulations of the air, by the cartilages of the outward part of the ear; but that happy obedience which originates in the affection of obeying is not possessed, and the bonds of the gospel become iron chains, which are heavy and galling. Something similar to this is seen in every-day life. Every one has felt the difference there is in obeying one whom we love, or where the commands are congenial to our feelings, from that of serving through compulsion, or where the service itself is irksome.

285. Anciently among the Jews, those who preferred obedience to their masters to freedom from their service, had the ear pierced by an awl, and by this token entered into perpetual bondage to them. At the present day, this would not be generally understood; but then, the science of correspondences being not wholly lost, the custom was recognized as having a spiritual origin, and not entirely arbitrary.

286. As there are various media through which sound reaches the ear (256), so there are different media through which impressions are received, that demand a willing reception by the inner man. The

most common are the written Word, the wholesome requirements of the church and society, and the warning voice of conscience, which, like a guardian angel, alarms us for our good, and only ceases to whisper in our ear when we have ceased to listen to her kindly admonitions.

287. There is great diversity in natural hearing (259), and no less in its analogy. Some obey in dogged silence; some, most cheerfully, but without knowing why; others, rationally; and still others, with an internal harmonious response to what is externally or perhaps spiritually received. These last are in a state which may be called celestial-natural as to their plane of obedience. The holy mandates penetrate the very soul, communicating a sense of melody which the most musical ear could not justly appreciate. The divine commands are to them more acceptable than wealth to the miser, or food to the hungry. The yoke is easy and the burden is light.

288. But true obedience must generally be learned (260). So much chaos remains in the unregenerated ear, that we have to learn obedience by a long and vigilant course of discipline. By self-denial, by watchfulness, and by partially obeying the various manifestations of the Divine will, man is brought into a state to enjoy as harmonies what was hitherto only discordant to his natural desires; for it is an all-pervading truth, that heavenly sounds are but grating discords to devils, and what are melodies to evil spirits are equally harsh to the heavenly ear. The experience of many will at once show them, that duties are now

discharged with pleasure, which some years ago were extremely repulsive ; and, when they were performed at all, it was with reluctance.

289. The smell corresponds to perception.

In the spiritual world, a sphere emanates from and surrounds every individual in a manner similar to the odor which is exhaled from the human body, animals, plants, and the like in the natural world. This sphere indicates the state of the spirit ; being agreeable or disagreeable according to the moral qualities of those who may be near each other.

“ Spheres are rendered sensible by odors, which spirits have a more exquisite perception of than men ; for, what is wonderful, odors correspond with spheres. They who have indulged themselves in dissimulation, and have contracted a nature thence, when their sphere is changed into an odor, it is like the stench of vomiting. Such as have studied the art of eloquence with no other view than to gain themselves admiration, when their sphere is made odoriferous, it is like the smell of burned bread. Where men have indulged in mere sensual pleasures, and have lived in no charity and faith, the odor of their sphere is like that of excrement. The case is the same with those who have passed their lives in adulteries ; but the odor of these is still more offensive. Where men have lived in violent hatred, revenge, and cruelty, their sphere, when changed into odors, has the stench of a dead carcass. Such as have been immersed in sordid avarice give forth a stench like that of mice. Such as have persecuted the innocent emit a stench like that of bugs.

These odors cannot be perceived by any man, unless his interior sensations are open, so as to give him sensible intercourse with spirits." A. C., 1514.

290. It is a fact worthy of observation, that children, and those who are nearest to a state of nature, are the most keen in the perception of the qualities of those they come in contact with; that is, are able soonest to detect in them whatever is congenial or averse to themselves. This is in perfect analogy with the relative powers of the sense of smell (264).

291. The intuitive power of judging of the moral or social states of others is highly useful to those whose rational faculties do not enable them to form an estimate upon other grounds. Many possess this power in a good degree, without being at all conscious of the source from which it is derived; and, where the possessors are in a virtuous and unsophisticated state, it serves to preserve them from defiling influences, as the sense of smell prevents the introduction of poisonous or putrid aliment.

We often hear a young or untutored person say, "I don't know why it is, but I cannot feel safe or comfortable in Mr. A.'s company;" while it would be said in reference to another, equally a stranger, "I feel quite at home with Mr. B., there is something about him so innocent." This sympathy or antipathy is dependent generally upon the spheres of the individuals meeting together, and has a very close connection with spiritual influences.

292. As sight is but the reception of an image caused by the rays of light entering the eye, and,

through it, affecting the sensorium ; so that to which sight corresponds, namely, the affection of being wise, is but the reception of spiritual light, or intelligence from the Lord, by the mind, and there forming an image of truth.

As the light of the natural sun daily shines upon man, and affords him all the external facilities for seeing, so the light of Divine truth is always ready to illumine the minds of those whose understandings are open to admit its rays.

293. But the spiritual sight may be, and often is, obscured by the films of self-derived intelligence ; so that what is purely spiritual can be seen but indistinctly. Truth is often distorted by passing through the medium of what is false, originating in our inherent evil propensities, which refract its rays to such a degree as to form a dull and blurred image of what should be seen in vivid light, and leave a distinct impression.

The eye corresponds to the understanding ; and the human understanding is very various in different nations, and still more in different individuals. Some can readily comprehend and rationally converse upon scientific subjects, and believe what is capable of demonstration, but do not possess any interior vision, to discern objects which appear in a higher order of light. They are clear-sighted in sensuous twilight, even more than others, but dazzled, and almost blinded, by the noon-day brightness of spiritual ideas. They say such ideas are of too transcendent and subtle a kind

to have a place in the human mind, but belong to the regions of fancy and imagination.

294. "That the sense of sight corresponds to the affection of understanding and being wise, is because the sight of the body altogether corresponds to the sight of its spirit, thus to the understanding. For there are two lights; one, which is of the world, from the sun; the other, which is of heaven, from the Lord. In the light of the world there is nothing of intelligence; but in the light of heaven there is intelligence. Hence, so far as with man the things which are of the light of the world are illuminated by those which are of the light of heaven, so far the man understands and is wise; thus so far as they correspond." A. C., 4405.

"That the sight of man depends upon his intellectual, is very manifest from this, that his natural affections effigy themselves representatively in the face; whereas the interior affections, which are of the thought, appear in the eyes from a certain flame of life, and thence evibration of light, which beams forth according to the affection in which the thought is." A. C., 4407.

295. The common expressions used in regard to the intellect are such as, in the nature of things, properly belong, or have reference, to the sight of the eye. Thus it is generally said of an intelligent person, that he is *clear-sighted*; of a shrewd one, that he is *sharp-sighted*; of an amorous one, that he has a *lascivious look*; of a pious one, that his *views* are not of an earthly nature; which expressions recognize the cor-

respondence which exists between the two kinds of vision.

296. In moral vision, the effect of a system of education, or habits of thought, are no less various than in natural (272). Some are quick to notice any divergence from rectitude in one class of virtues, while others of paramount or even greater moment are suffered to pass unnoticed. In looking at the complicated machinery of human life, some appreciate the bearings of all its wheels, see and feel interested in all the combined motions, and find their greatest delight in the providential results of their action on the large scale. Others look with indifference on whatever does not emanate from themselves, or in which something of self does not constitute a part. But the natural eye, faithful to its trust, transfers to its proper nerve the images of all that passes in review before it: so the love of wisdom should incite us to study diligently all those dispensations which affect the moral world, grow wise by a knowledge of their effects, and extend to others the benefit of that knowledge.

297. Taste corresponds to the perception and affection of spiritual nourishment. This is also founded in nature, and is so acknowledged by an interpretation of common language: for it is often said of a thoughtless person, that he has no *relish* for serious conversation; the worldly man says, I have lost my *taste* for devotional reading or reflection; another person says, I feasted upon the sermon, it afforded so much food for the mind.

“Inasmuch as food and nourishment correspond

to spiritual food and nourishment, thence the taste corresponds to the perception and affection thereof. Spiritual food is science, intelligence, and wisdom. From these, spirits and angels live, and from these are also nourished; and they desire and have appetite for them, as men who are hungry desire and have appetite for food; hence the appetite corresponds to that desire. And, what is surprising, from that food they also grow up to maturity." A. C., 4792.

298. To gratify the palate, so far as conduces to the health and usefulness of the individual, has been spoken of as its orderly use (286), and to go beyond this point as dangerous. The same holds true in the analogy or correspondence of the sense. Instances are not wanting where there is a keen appetite for scientific knowledge, and other forms of intellectual gratification, without a due regard to their original intention, which is to add to the sum of human happiness. All kinds of mental food are designed by Providence to be brought down into ultimates, and thus to become useful to the community. But many have a relish for their delicacies in the abstract, but no wish or apparent energy to render them serviceable to mankind at large; the consequence of which is to induce a plethoric or gouty state of the mind, which is incompatible with mental health or happiness.

299. Another form of vitiated taste is where one delights in the acquisition of the stores of wisdom, not that he may make others wise and happy, but that, by means of his superior intelligence, he may be elevated above his companions, and receive their homage.

This is a more prevalent abuse than the former, and even more pernicious in its consequences; for, as it is at variance with the order which prevails in heaven (though, like other inverted states, it may afford pleasure for the moment, from a gratification of self-love), it can yield no permanent enjoyment. It causes a species of spiritual corpulence, which may render the possessor an object of notice from his mere intellectual bulk; but his very size, or accumulation of selfish intelligence, will only make him the more unwieldy in his movements, and render him a burden to himself.

300. The touch corresponds to the affection of good.

This ought to be, in a spiritual point of view, as it is in the natural state, the most extensive or universal of any of the senses. The others are more or less local or restricted; but the limits of this are only found in the limits of the whole system. So it should be in its correspondence. The affection of good should be the consummation of all the other senses; and, like touch (282), it should be made the corrector or tester of the other spiritual faculties. It may be called the unerring sense; for, though the other forms may fail to guide us in the way of life, the affection of good is not prone to wander through forbidden paths, nor lead its possessor astray.

301. "The sense proper to conjugal love is the sense of touch. Every love has its sense; the love of seeing, from the love of understanding, has the sense of sight, and its pleasantnesses are symmetries and beauties; the love of hearing, from the love of heark-

ening and obeying, has the sense of hearing, and its pleasantnesses are harmonies; the love of knowing the things which flow about in the air, from the love of perceiving, has the sense of smell, and its pleasantnesses are fragrances; the love of nourishing one's self, from the love of imbuing one's self with goods and truths, has the sense of taste, and its enjoyments are dainties; the love of knowing objects, from the love of being careful for and defending one's self, has the sense of touch, and its pleasantnesses are titillations. That the love of conjoining one's self with a partner, from the love of uniting good and truth, has the sense of touch, is because that sense is common to all the senses, and thence draws portions from them; that this love brings into communion with itself all the aforesaid senses, and dedicates to itself their pleasantnesses, is known." C. L., 210.

302. Man corresponds to wisdom, and woman to love, or man to truth, and woman to good; and this is stamped upon the peculiarities of each (106). Thus the form and features of the male indicate mental as well as bodily power, or intellectual superiority; while the female, by the delicacy and smoothness of her countenance, the softness, roundness, and beauty of her form, seems more particularly to embody the affections. And it is from their mutual correspondence to the affections, for good and truth respectively, that in ultimate life there is so strong a reciprocal attachment between the sexes, and so much happiness follows their union.

303. Every one knows, that, however pure may be

the mutual affections of the sexes, there is an inclination to embrace the object of those affections. Though there may exist for a length of time an affection of the nature of esteem and friendship, yet, if it is accompanied by no desire to go beyond the ordinary enjoyments of conversation and social intercourse, it does not partake of the nature of conjugal love.

304. In the natural man, it is well known, that, in many instances, where there is a deficiency of the sense of sight, that of touch is so acute as to prevent deception in the examination of objects which are ordinarily detected by sight only ; such, for example, as the different metals, some of the colors and counterfeit coins. This may be seen to have an analogy in the affection of good, when unaided by the affection of wisdom : for there are instances where there is such a deficiency in the intellectual powers, that the subject is unable to appreciate truth in its various aspects, even though it be of the simplest kinds ; but, in all his duties, he seems to pursue the right under the sole guidance of the affection of good. You may reason with such a person in vain ; for, though you endeavor by the most artful sophistry to make the base metals of error pass for the pure gold of wisdom, his love of good acts as an unerring sense in guiding him to elementary truth, and in enabling him to avoid any form or degree of error which would tend to destroy this ruling love.

305. As the touch resides in the skin which envelops the whole body, the affection of good should enwrap the spiritual man, and leave no part exposed to those elements which are continually at war with

his existence. The natural skin, deprived of the sense of touch, or of the nerves which cause it, would but imperfectly protect the body from those agents which would act injuriously upon it: so truth in ultimates, to which the skin corresponds, would be inadequate to preserve the soul from those spheres which would exert a poisonous influence, but would have its vital discrimination so enlivened by union with the love of good, as to cause it to shrink with instinctive dread from the contact of sin.

SECRETION AND EXCRETION.

306. Mention has already been made of some of the secretions, such as the saliva (136); but, as quite a class of glands exists in the system, whose use is to provide certain fluids for the different vital processes, or to secrete others, which, if retained, would prove injurious, a more detailed and definite account will be necessary.

These secretions and excretions are said to be effected by certain glands, specially devoted to that use; but recent minute examinations of the structure of the various secreting organs lead to the conclusion, that a simple membrane, like the mucous membrane which lines the nose, is all that is absolutely necessary to any such process. And the different viscera, which, in the human body and that of the higher animals, are

devoted to the secretions, seem to possess the form of glands, such as the liver and kidneys, merely for the sake of combining extent of membranous surface with compactness of form; for it is very evident, that a membrane may be much more extensive by being folded in upon itself, in a million of minute convolutions, within a certain space, than if it were spread out in a smooth and even manner, like the lining membrane of the chest.

But there is a marked difference in the peculiar manner in which this secreting membrane is disposed in the glands which secrete different fluids. Thus the mammary gland, which secretes milk, is widely different in structure from the kidney, which excretes urine; and still, both equally consist of membrane, folded into tubes and sacs, from the inner surface of which the peculiar product of each is formed.

307. From some of the glands a fluid is formed which is wholly used in the nutritive process; from others, one which is only partially so; while from a third the product is quite useless, and only designed to be thrown out of the system in the most expeditious and convenient manner possible. An example of the first class is the saliva; of the second, the bile; and of the third, the urine. This last kind is properly denominated an *excretion*; for it consists of effete substances, which, if retained in the blood, would exert a poisonous influence upon the tissues; but the retention of the healthy secretions, though injurious, is so in a much less degree.

308. The microscopical observations of Purkinjo

and others have established the fact, that the function of secretion is in animals (as it has been long known to be in plants) performed by the agency of cells of extreme minuteness; the agency of the different forms of membrane being to afford the necessary facilities for the generation of these cells. This is very similar to the process of nutrition; the difference being, that the latter is designed to give origin to substances which are to promote the growth of a part, while the former is concerned in the separation of its products from the body, to whose growth it does not directly contribute; but the incipient stages in both processes are the same.

BILE.

309. In the chapter on respiration, it was shown that the blood had to be vivified and purified by being brought into contact with the air in the lungs. But the blood contains, in the returning part of its circuit, other impurities, which are to be separated from it by excretion; and the agency of the liver, in eliminating from it the peculiar substance called bile, is absolutely necessary to the maintenance of the healthy state. Its retention in the circulating fluid gives rise to the various disorders which are commonly known by the name of bilious; and, in whatever shape they are manifested, they cause a general lassitude and sense of heaviness, and often severe distress. The elements of it exist in the blood, even before it approaches the liver; but these elements are separated and brought into the specific form of the secretion in that viscus.

310. When properly formed, the bile is a ropy, slightly adhesive fluid, of a yellow or greenish color, and of an extremely disagreeable, bitter taste. In the bowels its action is gently purgative, which seems to be its most important use in the animal economy after its own formation, — uniting with the refuse, indigestible portion of the food, and urging it onwards in its course down the alimentary canal. It is supposed to exert some influence in preparing the chyle for absorption. This, however, is not caused by its uniting with the chyle; but its influence is dependent upon its qualities as a precipitant.

311. The bile is not secreted from all the venous blood, but only from that portion which is returning from those vessels which are distributed on and about the intestines. These veins returning towards the heart collect the worn-out blood from the mesentery, and the vicinity of those viscera which are engaged in forming the chyle, and unite in that called the *vena portæ*, which enters the liver like an artery, dividing as it penetrates its substance, not that it may nourish the organ as arteries generally do, but that the fluid which it transmits may undergo a process of purification. One principal part of the purification consists in removing the carbon which is too abundant; and in this respect, but not in others, the office of the liver is similar to that of the lungs.

312. When the bile is formed, as much of it as is necessary is poured into the intestines, for the purpose already mentioned; and any superfluous quantity which may be secreted is stored up in the gall-bladder

to supply the future demands of the system. The rapidity of its formation is partly dependent upon the quantity of food which has been taken, but partly also upon its qualities. It will, however, continue to be formed after the individual has ceased to take any kind of nourishment; and then, there being no demand for it in the bowels, it will collect in the gall-bladder, which will become distended in consequence, as is frequently seen in cases of death from starvation.

313. The liver is formed in almost all grades of the animal kingdom, and, in the lower orders, bears an inverse ratio to the development of the lungs or gills. In the foetus, also, whose lungs are not yet inflated with air, the liver is of double the relative size which it possesses a few months after birth. The reason of this ratio is, that they are both concerned in separating carbon from the blood; and, where the lungs are in a degree deficient, there is more of this kind of labor to be performed by the liver, which, to meet the exigency, must be more fully developed.

Its structure may be found in every degree of perfection, from a simple membranous sac, closed at one end and open at the other, to discharge the secretion into the intestinal tube, to the fully developed organ which is found in carnivorous animals, and which is even more complex than in man.

314. Of all the excretions, none is so perfectly

worthless as this. Its chemical constitution is such as to render it poisonous if retained in the blood ; its ingredients being disposed to assume the crystalline form, if separated, or even if allowed to remain at rest. When removed from the system, it soon becomes partially decomposed, and emits a stench which is peculiar and very offensive. If retained in the blood, it causes great disturbance in the nervous system, similar to that produced by the narcotic poisons, and death takes place in the form of stupor or fainting ; not, however, before the whole system has suffered the most severe distress.

As is the case respecting the bile, the elements of this excretion pre-exist in the blood ; and it is the office of the kidney to separate them from it, and reduce them to that form which they ultimately assume.

315. The shape of the kidney is familiar, being in its contour somewhat like the external ear, or still more like that of the kidney-bean. It is abundantly supplied with blood from the renal artery, from which it separates its urea (which in small portion may always be found in the circulation), and its other deleterious components. It also separates the superabundant water, which is not otherwise removed from the system, by the exhalation of the lungs and the perspiration of the skin.

On entering the kidney, the blood is distributed, by minute ramifications of the artery, in the substance of the gland, and principally to the peripheral or cortical substance, which is the more active secreting

portion. Here the elimination of the urine commences; and, as it passes through the cones toward the pelvis or concave part of the organ, its characters become more distinct; and by the time it is discharged into the ureter, on its way to the bladder, it has all the qualities which it manifests on being removed from the system. But the longer it remains in the bladder, the more of its aqueous parts are absorbed, and the more concentrated its peculiar qualities become. It is chiefly through this excretion that those saline matters which have aided in digestion, and have become of no further use, are caused to pass out of the body.

316. There is a great difference in the length of time which is required by different substances in their passage from the stomach or lungs to the kidneys. Some, as the common animal and vegetable principles, require two or three hours; while others of a volatile or diffusible kind, such as spirits of turpentine, may be detected in the urine which is voided a few minutes after the fluid has been taken into the stomach, or its vapor inhaled by the lungs. This is much the case, too, with those neutral salts, which are well known to exert a stimulating influence upon these organs.

317. The quality of the ingested food produces a marked effect upon this excretion, owing to those unassimilable ingredients which are found, in different degrees, in the various kinds of aliment. But, notwithstanding the influence of the kidneys in freeing the fluids of the system from the injurious parts of

what is taken as food, yet there are some kinds which so abound in noxious qualities, that the power of these glands is too limited to separate them sufficiently to maintain a healthy state; which state, consequently, can only be preserved by recourse to some other kind of diet.

CUTANEOUS PRODUCTS.

318. The moisture which is transmitted through the skin, and known as perspiration or sweat, is nearly allied, in some of its qualities, to the foregoing fluid, and produces some of the milder of its injurious effects, when its excretion becomes obstructed. It is not, however, so useless; for it serves to moisten the surface, and thus prevent that dry, parched state of the cuticle, or scarf-skin, which is found when this is deficient, and to prevent its chafing from the friction of its contiguous portions against each other, or the irritation of foreign substances. It also serves, by its evaporation from the surface, to regulate the temperature of the body when too high.

319. Besides the more thin, saline parts of the perspiration, there is an oily substance, which, in some persons, is deposited upon the surface in such quantity as to give it quite a greasy appearance, and constitutes some portion of the secretions of the skin in every one. The sebaceous follicles also pour out, from their numerous small ducts, an unctuous substance, which helps to make up this composite fluid.

320. The pores, through which these secretions are

transmitted, are extremely numerous, and to be found on all parts of the body; some varieties prevailing in one portion of it, and some in another. Where the cuticle and true skin are thick, the excretory duct of the subcutaneous glands and follicles penetrates them in a spiral manner, and opens by an orifice; which, like the pores of the skin, is too small to be visible to the naked eye. The skin is well known to be supplied with odoriferous glands, which differ, in different individuals, to such a degree, that, in the absence of more palpable evidence, their identity might be ascertained by their peculiar odor.

As part of the cutaneous transpiration possesses an adhesive quality, it is disposed to clog up the outer orifice of the pores, and thus form an obstruction to the perspiration, which is best removed by a free use of warm water, and sufficient friction to cleanse the surface. But, where the obstruction exists for want of a propelling force, energetic exercise, by increasing the force of the circulation, will most readily remove it.

TEARS.

321. The lachrymal gland, which is that by which the tears are secreted, is situated in the upper and inner part of the orbit, resting, as it were, upon the upper and posterior portion of the eyeball. It is a small gland, which, under ordinary circumstances, does not secrete much fluid; merely sufficient to moisten the inner surface of the eyelids, the surface of the ball, and the nasal passages. But, under the

moderate excitement of joy, grief, or any of the more tender feelings, the flow of the tears is often so profuse as to be unable to pass through the nasal duct; and they consequently run over the lower eyelid, and flow down the cheeks. The supply of fluid to the eyeball is generally so ample that few have any idea of the inconvenience caused by its deficiency; still, those whose time is much devoted to studious occupation sometimes suffer much from the dryness of the eyes, and a peculiar sensation, as if they were irritated by fine dust.

322. The tears are composed of mucus, saline matter, albumen, and water; and, from their composition, are perfectly adapted to their office: and, where they are deficient, water, when applied to the eyes, proves but an indifferent substitute. Their action is not confined to the moistening of the eye; but they perform an important office in clearing away any foreign particles which may be in contact with its surface.

MILK.

323. This secretion is different, in all respects, from any of the former; being nutritious and palatable, and more perfectly suitable for the support of the infant than any other substance. Its general characters and external appearance are too well known to need a remark; but something may be said, with propriety, of its more hidden qualities. It consists, like other fluids, mostly of water, but holds in solution

albumen, oil, sugar, some saline matters (as phosphate of lime and magnesia), and casein, or that principle which is the chief component of cheese. It will thus be seen to combine in itself all those ingredients which are indispensable to the sustenance of animal life, and it is the only substance in nature which does so.

324. If milk be allowed to remain at rest, a spontaneous separation takes place to a certain extent; the more oily parts, by their less specific gravity, rising to the surface in the form of cream. This separation also takes place, though to less extent, in the cow and similar animals, before the milk is drawn from their bags: for that which is first drawn, being the lowest stratum, is comparatively thin; while the more oily portion, rising to the upper section of the reservoir, is the last to be obtained, and is nearly allied to cream.

In addition to the prevalent characters of milk, that which is formed at or during the first days of lactation possesses decidedly purgative qualities, — a wise provision for the removal, from the bowels of the newly-born infant, of the meconium, a viscid and effete excrement, which would be injurious if not got rid of soon after birth.

325. The cheesy, oily, albuminous, and saccharine portions of the milk enter readily, by digestion, into the blood, and thence are assimilated by all the softer tissues contributing to their growth and development; while the salts of lime are deposited in the cells of the bony framework, adding to their firmness and

solidity. The water, too, which so predominates, is even more indispensable to the economy of the infant than to that of the adult, whose system requires less moisture.

As some substances from the parent, which are not assimilable by the tissues of the infant, enter into this secretion, it is necessary that all should go through the process of thorough digestion, and all those parts which are useless or deleterious be rejected by the absorbents of the child, as perfectly as they would be if any less suitable food were made use of.

326. It has long been known, that the secretion of milk is affected by the passions and very marked peculiarities of the individual to a considerable degree. A case occurred in my practice, about five years ago, which would lead to the conclusion that bodily pain may have a similar influence. A young woman, soon after the birth of her second child, was nursing it, when she was seized with a pain so violent that it was with difficulty she could avoid groaning or crying out; yet, rather than disturb the infant by removing it from the breast, or by loud complaint, she continued to endure the agony in silence; but, in a few moments, the child shrieked out as if from a severe injury or acute pain, and could not at the time be induced to nurse again, nor be pacified by any endearments for several minutes. Not thinking of any way in which the infant could be hurt while lying so peacefully in her arms, she examined its clothes with peculiar care, but without finding any cause for its complaints. The uniform health of the

child seemed to increase the probability that its sudden and severe but transient attack was owing to some intimate connection between the milk and the mother's distress.

327. The gland by which this nutritious fluid is secreted is the peculiar feature which distinguishes the large and important class of animals denominated mammalia. Its form is somewhat various in the different species, but marked by the same prominent structural peculiarities. It is thus described by Dr. Carpenter: —

“It consists of a series of ducts passing inwards from their termination in the nipple, and then ramifying like the roots of a tree; their ultimate subdivisions terminating in minute cells. The mammillary tubes are usually about ten or twelve in number; they are straight ducts of somewhat variable size, and, concealed by the overlapping of its sides, are narrower than the tubes themselves. At the base of the nipple, these tubes dilate into reservoirs which extend beneath the areola, and to some distance from the gland, when the breast is in a state of lactation. These are much larger in the lower mammalia than in the human female; their use being to supply the immediate wants of the child, when it is first applied to the breast. From each of these reservoirs commence five or six main branches of the lactiferous tubes, each of which speedily subdivides into smaller ones; and these again divaricate until their size is very much reduced, and their extent greatly increased.”

328. This gland is developed in the fœtus; but it

is not until about the age of fourteen years that it assumes its ordinary size, and is capable of discharging its duties as a secreting organ. From this period of life to that of forty-five or fifty years, it remains in the exercise of its functional powers, if required ; but, after that time, its shape is preserved by a deposit of fat in its cells, but its office as a gland ceases for ever.

ANALOGY OF SECRETION AND EXCRETION.

329. In man the spiritual part or soul is no less filled with impurities than the body ; and these require a constant process of removal, as much as do the deleterious fluids in the natural circulation. This process in the psychical economy corresponds to the various natural secretions and excretions. But the imperfections of the soul are such, that, in the introduction of new truths and those moral affections which serve as food, some of the forms of self-love have to be mingled with them to cause them to be readily imbibed by the mind ; and this proprial or self-derived admixture is in analogy with those secretions, which are of some further use in the body, and generally exert an influence in the digestion, as do the saliva and the bile (147).

330. Gall or bile corresponds to “evil and false commixed with good and truth.” No one who is acquainted with the corruption and intricacies of the human soul will suppose, that its food, which is truth and love of Divine origin, can be received and appropriated without being combined with some active

principle in the individual himself. This is well known and acted upon by shrewd proselyters, who, by studying the mental constitution of the subjects of their designs, ascertain what feelings or preconceived opinions they can most successfully appeal to in furtherance of their ends.

Any spiritual food which is not thus mingled, in its reception, with something self-derived (and which will of course be in a great degree false and evil), will not undergo that interior assimilation which will make it a part of the individual.

331. These proprial evils and falses, though they for a time combine with the received knowledges, do not eventually enter into the construction of the soul, any more than bile, in health, constitutes part of the tissues, or is a permanent ingredient in the blood. And, when they do really and permanently so combine with the thoughts and affections, their action is to cause a degree of inertness in spiritual life similar to jaundice, which renders the subject of it useless; and, if not soon purged from the soul, will cause the death of all those mental states which lead toward regeneration. Their action will thus be seen to be that of a precipitant, to prepare truth for interior appropriation, and then to be purged away with those effete propensities which are innutritious to the regenerate mind.

332. If there should be at any time a great deficiency of spiritual nourishment received, there will be an accumulation of false and evil principles (312) in the system; and as there are no sufficiently strong

powers in the soul to cause their removal, without the stimulus of demand occasioned by suitable food, these false principles will continue to be generated from the latent evils in the mind, to the very close of good life from moral starvation. So very true is this, that we often hear the homely saying repeated, that an idle brain is the devil's workshop. But where an energetic process of mental growth is going on, though these principles are consequently being eliminated, they are as constantly passing off in a healthy manner.

333. In all stages of regeneration, something analogous to the biliary secretion is found, but differing widely according to the degree of advancement. There are some in so low and incipient a state, that almost the whole process of purification is analogous to the action of the liver, where there is a commixture of evil with good. They cannot be said to breathe a Divine atmosphere, by which the "pride of self-derived intelligence" (to which coals or carbon corresponds) can more effectually be got rid of (313), and their only improvement is to be effected through a kind of biliary purgation.

334. The defilements of truth correspond to urine, and of course can have no abiding place in the regenerate mind. And it is very evident, that any person who is delighted with the profane or obscene use of holy things can feel no real delight in those truths for their own sake, or cherish any veneration for their Origin. Profane ideas will often enter in a measure unbidden, but not without some cause referable to the

subject of them; but, if they are unwelcome guests, the effort to eject them will make their stay short. If, however, they are retained in the moral circulation, their poisonous influence (314) will be such as to pollute all that which would otherwise be pure in the human mind. These defiling principles can have no agency in the elaboration of knowledges or affections for mental growth or moral improvement; and it should be the constant endeavor to free it from them. And whatever self-originated profanation adheres to or combines with those purer ideas which are of spiritual origin should not be suffered to remain, or defile that which is intended for man's advancement.

335. "Sweat denotes the proprium of man." It is from the sphere which emanates from man, and which is analogous to the insensible perspiration, that his qualities are often known even in this world; and this will be more perfectly the case when he lays aside the natural body. This is his self-hood, and constitutes the most certain evidence of his identity. If he remain bound up in self, and does not promote that healthy change of constituents which is the result of religious activity, he will induce a state similar to that of obstructed perspiration in the body. But if, by a ready reception, spiritual nourishment is taken, and, by the active duties of life, this nourishment, after becoming a part of the individual, is expended in outward act, the proprium or self-hood will be eliminated so fast, that the soul will be kept free from the injurious effects of its accumulation. Man's very position in society is favorable to these changes; and it is

well known that the sphere of the hermit or recluse is strongly impregnated with the odor of self, which free and cheerful intercourse with the world would strongly tend to lessen.

336. "Tears signify grief on account of there being no understanding of truth." The reason of this will be obvious from a reference to the correspondence of the eye to the understanding. If that power of the mind be obscured, the effect of this grief is, first to increase the darkness of mental vision, but only so as to prepare for an increased degree of its subsequent clearness. By its action, the motes which float before the spiritual eye are washed away, and the individual will have a more lucid and satisfactory understanding of truth. The kind of grief here spoken of is not of common occurrence. Grief generally arises from sources almost opposite to the origin of this ; namely, from obstacles to the gratification of some of the forms of self-love, or obscurations of self-derived intelligence ; but that kind of grief has little to do with regenerative states, and is not productive of subsequent clearness of understanding.

337. The correspondence of milk varies some, according to the subject in relation to which it is predicated. As a secretion adapted to the nourishment of the infant state, it would signify spiritual good.

The novitiate Christian requires the truths to be prepared for him, and, by the agency of those who stand related to him as parents, fitted to invigorate his feeble system. Truths form a part of his suitable diet ; but good of a spiritual kind must lay the ground-

work of his future growth. If the various kinds of spiritual good are implanted, such for example as the good of temperance, the good of obedience, the good of integrity, those truths which are adapted to the completion of these virtues will be eagerly imbibed.

338. The church is to Christians a spiritual mother ; and it should be to the church that those who wish to be regenerated should look for spiritual good and truth, which are to the soul what food and drink are to the body. Though it is the effort of Providence to prevent the impurities of the church from affecting the salvation of its younger members, yet some contaminating influences will be felt where the church is not in an orderly condition. But the first cravings of one who begins to wish to be saved is for that which will most effectually and speedily contribute to his salvation ; and a church must be in a corrupt state indeed, which, if its children ask bread, will give them a stone ; or, if they ask a fish, will give them a serpent.

339. As the natural secretion of milk is much influenced by the presence of the child, so the desire to furnish spiritual sustenance to those who hunger and thirst after righteousness is the strongest incentive to action in preparing the same for those who may be in a state to receive and appropriate it.

One of the first effects of spiritual good, when received into the system, is to purge off the previously existing impurities (324), and prepare the mind for a kind of aliment to which it has not as yet been accustomed.

THE NERVOUS AND MUSCULAR SYSTEMS.

340. In addition to the special functions of Digestion, Nutrition, Respiration, &c., there are others of a more general nature, both as to their diffusion through the system, and as to their office in aiding all the more definite ones. In their action they are quite dependent upon each other; and the results of their actions are favorable in proportion to the perfection of their mutual agreement, the harmony of their combined efforts, or the regularity with which the influence of one is propagated through the more subordinate.

NERVES.

341. The highest or most interior of these systems is the nervous. It is that part, more especially, through which ideas are received and propagated to those organs which connect man with outward nature; and it also constitutes the chain of communication from external things to the sensorium. But this system is so harmoniously blended with those through which it exerts its influence, that we are unconscious, in most cases, of any distinctness in its agency; and, were it not from knowledge gained by experimental inquiries and anatomical research, man would not know that his hand is connected by nerves with the brain, or that a distribution of nerves to the fibres

of the museles gives them the ability to act in accordance with the volitions.

. . . . "In man are many and innumerable things ; but man still feels them as one. He does not from sense know any thing concerning his brain, concerning his heart and lungs, concerning his liver, spleen, and pancreas ; nor concerning the innumerable things in his eyes, ears, stomach, and the rest ; and, because from sense he does not know these things, he is to himself as one." D. L. & W., n. 22.

342. Though the nerves, ordinarily, are supposed to convey the mandates of the will to the more extreme parts, this is by no means their only office. A large class of them are endowed with a function which has no connection whatever with the mind, and its action is called *reflex* ; that is, the impression which is antecedent to and the proximate cause of the action is communicated to the spinal column, and movements are produced without consciousness on the part of the individual, and often without any sensation ; nor, in many cases, can the strongest volitions interfere permanently with their production.

This reflex action is better fitted to sustain those motions for which they are designed than any volitional agency could. Thus, for example, if man should breathe only when he directed his mind to that function, he would be liable, every hour of his life, to be brought to the verge of suffocation, before his attention could be sufficiently aroused to direct his agency to the respiratory movements.

343. The functions of the spinal cord, and the

nerves which originate in it, are, in some other respects, peculiar. They have justly been said by Dr. Hall "never to sleep or relax their wonted activity." They also do not tire in the discharge of their offices; but, after the continual labor of thirty or forty years, their task is performed with the same alacrity as during the first months of life. Their action, too, like the instinctive powers of animals, is seldom known to err; and, when it does, the error owes its existence to some of the misguiding influences of the human will.

344. The successful investigations of Sir Charles Bell, and other physiologists of our day, have shown that most of the nerves are composed of different fibres or traets, having each different offices to fill. One of these divisions conveys sensations to the nervous centres, and makes the mind cognizant of outward impressions; while another, though enclosed in the same sheath, conveys to the musele or extremity that mental or emotional impulse which causes the part to act in accordance with it. If that portion of a nerve which conveys sensation be divided, the power of feeling in the part to which the nerve is distributed will be lost; but still the power of motion will be retained, and *vice versa*.

345. Most functions are partly under the control of the will, they having nervous communication with the brain, and are partly governed by the reflex action of spinal nerves. This is the case with respiration. Man can breathe or cease to breathe for a short time, as he may choose; or he can breathe fast or slow, when he

directs his mind to that process; and, by this power of the will, he is enabled to make the respiration subservient to another use in his economy, — that of forming the air he breathes into articulate sounds, and, by their aid, expressing his wants. But there are limits in his power over the respiratory function, beyond which he cannot pass. Thus, if he should attempt to hold his breath, as soon as the demand for fresh air, to aërate the blood which may be in the lungs, has become sufficiently urgent, no efforts of the will can be exerted with energy enough to counteract the reflex agency of the other set of nerves, which, by a kind of spasmodic action, will produce an act of inspiration.

346. The act of swallowing is also partly a combined one, but differing from respiration in this respect, that the bringing a morsel of food, or draught of fluid, into contact with the pharynx, or most posterior part of the mouth, is a voluntary act, but the remainder of the process is wholly of a reflex nature, and entirely independent of the mind; nor are the subsequent stages accompanied by sensation, unless the morsel be so large as to press considerably upon the surrounding parts, or so cold as to be sensibly felt in consequence of that quality.

347. Digestion, when proceeding in a healthy manner, goes on through its various stages, without exciting the notice of the individual; its nervous influence being reflex. Still it is so far connected with the general sympathetic system, that any strong emotion or great mental depression will derange its order, and retard its regular advancement. This is also the case

with the other visceral actions ; the mind, if acting at all, doing it in a very indirect way.

The spinal nerves exert a peculiar protective influence where they are distributed, and thus produce a security from sudden injury which could not well be effected by the activity of the mental powers. The closure of the eyelids is owing to reflex action ; and this accounts for the suddenness of the closure, upon the eye being threatened by any immediate danger, without the intervention of the mind, and sooner than the mind could be called in to their aid.

348. The brain gives origin to some nerves which have a slightly reflex action ; but this is not general. It is admitted to be the seat of the intellectual and moral powers, and the principal source of those nerves which contribute to the perfection of the senses. The amount of intelligence is proportioned to the size of this gland, when compared with the aggregate of all the nerves which proceed from it. Agreeably to this view, man should be far above all the other animals ; for, though some may have larger brains, none has one which is *relatively* so large.

349. The nature of a nerve is much changed by passing through a tubercular enlargement called a ganglion. This is to be accounted for by the fact, that different nerves, and different fibres of the same nerve, on entering one of these ganglia, exchange with each other ; one giving off to the other sensitive filaments, and another motor ones, and both receiving the opposite in return. This interchange is somewhat like the anastomosing of bloodvessels, and serves to

secure to the distant parts the full functional powers of the different portions of the system.

350. The nervous centres are extremely well protected; the brain being enclosed in a cavity formed of double plates of bone, united to each other in the best possible manner to secure themselves from fractures. The spinal cord, too, through its whole extent, running along a bony canal, is the most safely lodged that it could be for so extensive a substance. The great sympathetic nerve or ganglion lies in so central a part of the body that its safety is as great as either of the others.

351. All the functions of life are dependent on the nervous system for that peculiar stimulus or agency which causes the more remote parts to take on their functional offices, whether these are secreting membranes, digestive organs, complicate glands, or the special organs of sense. And to render the nervous circle perfect, almost every part, however minute, is supplied with a centripetal branch, to convey the impression of local demands to the sensorium or centre of reflex action; and a centrifugal, which brings back the requisite stimulus from the interior or nervous origin.

352. The rapidity with which influences are transmitted through the various channels surpasses any thing in the human system, except the quickness of thought or the flights of the imagination, which are of too immaterial and subtle a nature to be brought into just comparison with any thing which has a tangible existence.

353. Nerves in their course do not necessarily communicate their peculiar stimulus to all those parts through which they may be traced; for they often pass through the substance of a muscle, or a thick deposit of fat, to be distributed upon, or ramify through, some other part; and that part where it terminates by infinitesimal twigs, or bends round in microscopical loops, is the one where the greatest influence is felt.

MUSCLES.

354. The muscles constitute that portion of the body which is commonly called the lean of meat. Their action is mechanical, serving the purposes of locomotion and the various movements of the members, and also many of those changes which take place in the more internal organs. They are distributed through and about every part of the body, where movements are necessary or convenient. They are liberally supplied with bloodvessels and nerves; the first for their nourishment and growth, and the second for their sensation, but more especially for the power which stimulates them to action.

355. In shape the muscles are quite various. Those of animal life, such as those which bend or extend the limbs, are generally quite long and comparatively slender, as those which move the fingers, toes, forearm, and leg; others are broad and rather flat, as that upon the breast, which moves the arm, and those upon the back, which serve a similar purpose; others

again are short and thick, as those which move the thigh, and that upon the shoulder, which elevates the arm. Those of organic life are sometimes hollow, as the auricles and ventricles of the heart; others expanded, as the diaphragm; and others tubular, as in the alimentary canal.

356. In structure there is a prominent difference between those of organic and those of animal life. In the muscle of animal life, the fibrils are generally coarser, and marked by transverse striæ, which, when examined with the aid of the microscope, give to the texture the appearance of being diversified by light and shade. Those of organic life have a more compact arrangement, and present nothing of this striated appearance.

357. It has long been a question how muscular contractions are effected. It was formerly supposed, that the ultimate fibrils were bent by the nervous stimulus; and, their aggregate length being thereby diminished, the necessary contraction would take place. But recent investigations have shown, that the fibrils assume this angular or curved arrangement while resting, and become condensed in substance (like India rubber when pressed), while under the contractile stimulus of nerves or galvanism. In this manner a series of fibres will swell out in bead-like order, which is supposed to be the cause of the striated appearance of the voluntary muscles.

358. The fibrils which run longitudinally, or in the direction in which the muscle is to act, are united by cellular tissue, into fasciculi, which are called fibres;

and these fibres again are united by the same means into larger bundles, while the union of many bundles constitutes a muscle. When broken across by extreme tension, the fibrillar arrangement is rendered very manifest. The cellular tissue which unites the fibrils assumes the form of a sheath, and is called the *sarcolemma*, which is to the fibre of muscle what the *neurilemma* or nerve-sheath is to nerves. Entire muscles are often invested by a larger form of sheath, called a *fascia*, which serves to bring the fibres and muscles in close apposition with each other, and give the whole a compactness which in most parts of the body is very desirable. By this general compression in a lateral direction, the fibres, which might otherwise be cylindrical, are brought into a polygonal form. There are, therefore, no interspaces left; and consequently, under violent contraction, the moisture, which is ordinarily diffused through the muscular substance, is forced out in the form of minute bladders on the surface of the fasciculi.

359. The ultimate constitution of the muscle is in microscopical grains or spherules. These, during the contraction of a fibril, assume the form of discs or flattened spheres; their sides being brought into contact with each other, and thus laying the basis for all muscular action.

360. During the contraction of a fasciculus, one fibre will be at rest, while another is contracted: these will, throughout a muscle, alternate with each other, so that no bundle of fibres can at any time be found to be all acting at the same moment. This alternate

contraction and relaxation gives rise to a peculiar, gentle, rustling sound among the fibres, while the whole substance is undergoing the greatest amount of exertion it is capable of. In addition to these times of rest to the individual fibrils, there must also be longer periods of rest to the whole muscle; and those of animal life require certain general times of rest, in which they all are simultaneously free from exertion, as takes place when the body is in a horizontal posture, and the senses are in a dormant state.

361. The bones serve as levers upon which the muscles act, somewhat after the manner of pulleys; and, when we take into consideration that the insertion of the muscle is unfavorable to the exertion of its power, this being sacrificed to convenience of function and compactness of structure, it is astonishing to calculate the amount of strength which is possessed by the muscular texture, while endowed with vitality. But if a muscle, which, under the power of innervation, was capable of sustaining a weight of half a ton, be deprived of life, though all its tangible qualities remain the same, it will be torn asunder by a force not equal to an hundred pounds.

362. The muscular system is endowed with a power of judging of certain states peculiar to itself, to which physiologists have given the name of the muscular sense. By this power we are enabled to judge of the weight or resistance of objects to a certain degree, as different sensations will be felt according to the amount of physical force required. The sense of fatigue is attributable to the same source.

363. Some idea may be formed of the rapidity with which the contraction and relaxation of some *museles* succeed each other, by the motion of the fingers of a skilful performer on many kinds of musical instruments, or the celerity of the vocal *museles* in the articulation of words; but even these quick changes are immediately thrown into the shade by the surprising velocity of the wings of the humming-bird, or those of thousands of insects, which vibrate more than a thousand times in a second, as may be easily ascertained by the *tone* caused by their vibration.

364. Muscular contractility remains for different lengths of time, after the death of the nervous system, in different classes of animals, and in different parts of the body; some apparently dying almost as soon as the nerves which stimulate them, while others will contract under the influence of galvanism, even hours after the death of the nervous system. The prolongation of the contractile power is much influenced by the manner in which death takes place. Thus, if the nervous centres be crushed instantaneously, or their life be destroyed by lightning, the muscular system loses its vitality at once; but, if the death of the nerves be gradual, the *museles* will retain their irritability for some time.

ANALOGY OF THE NERVOUS AND MUSCULAR SYSTEMS.

365. The division of society into the thinking and laboring portions of the community affords a parallel to the nervous and muscular systems, which is in

most respects perfect. This division contributes to the strength and activity of a body of men, in proportion as the two divisions are distinct in function, and harmonious in action, throughout the business and enjoyments of life. The thinking portion is the more elevated in its character, if its duties be discharged in an orderly manner, and its enjoyments are of a more refined and intellectual cast: there is something more ethereal in its elements. But, if the pleasures of this class are more exquisite, their pains are proportionally more acute. Though their office is more elevated, their usefulness in the political economy is wholly dependent upon the effective manner in which their designs are brought out into ultimate acts by the operative class, which constitutes the bone and muscle of every state.

366. Though the laborer has not that degree of mental delight which at times lights up the intelligent eye, yet he feels a general buoyancy of spirits, an elasticity in his limbs, to which the man of letters is a stranger. He also has much more passive enjoyment; the *animal* functions are more regularly performed; and “the sleep of the laboring man is sweet, whether he eat little or much.”

But, in most forms of society, each individual unites in himself something of the character of both classes; having a mind enriched, in some degree, with the knowledge and refinement of the one, and a body preserved in health and strength by the habits of the other. And this is an orderly arrangement; for we find few organs in the body which have not a regular distribution of both nervous and muscular filaments.

367. The feeling of hostility which often prevails in society, between different classes of men, meets with no parallel in the human system in a healthy state ; for it is only when disease has invaded the different tissues that man becomes conscious that there is not a perfect unity in all the component parts of the body. But, in proportion as the body becomes disordered, he feels that he has a stomach by the painful sensation which arises in it, and knows by experience that a certain pain proceeds from the nerves, and another from the muscles, while a third is referred to the bones. So in society, while all the duties of the various classes are discharged with alacrity, and in the love of being useful to the community, nothing is heard of clashing interests, of abuse of power by the ruling portion, or of disobedience or unfaithfulness on the part of those who are more subordinate. All their united acts give evidence of the perfect unity which prevails within. But, when self-love becomes so engrossing as to throw the love of the neighbor into the shade, each strives to raise himself, or the class to which he belongs, at the expense of others, and without the most distant regard to their welfare ; he even rejoices at the overthrow of his equals and superiors, that he may elevate himself upon their ruins, or delights in those misfortunes of his inferiors which will prevent them from becoming his rivals in wealth or power. In this state (which has for ages been prevalent in the world), man not only sees in society a disunited community, but even attributes disunion to the Deity ; and, instead of worshipping One God, he prays to one person to intercede with a

second, to send a third to gratify some of his selfish wishes; and thus carves out, in his imagination, a graven image of the Trinity, in which no just semblance of Unity remains.

368. But man was created in the image of his Maker; and in him is seen a perfect unity. When we think of a man, we think neither of his body as separate from his soul, nor of his soul as distinct from his body; but we regard the soul, body, and those acts which habitually proceed from the union of them, as a distinct one; and nearly in proportion as we destroy the unity of man, we destroy his identity. Now, if man be an image of his Maker, what holds true of one will hold true of the other, as nearly as finite can be the image of the Infinite; and to separate the Deity into three distinct persons would be as subversive of a correct and distinct idea of his Being, as the separation of a man into the body, soul, and proceeding acts of which he is composed, would be destructive to his existence as a natural man.

369. As the chief nervous centre is placed in the head and governs the general actions of the body, it is in accordance with natural order, that, in every state or society, there should be a properly constituted head, or ruling power, whose office is to regulate the general acts of the community, so that the greatest good may be effected in the best possible manner. There would be no more propriety in the mass of the community envying the political head, or opposing his orderly acts, than there would in the hand or foot rebelling against the natural head. And when an individual, or class of men, assume to themselves the

privilege of acting against the common laws, a political disorder like St. Vitus's dance usurps the place of social health and harmony.

370. In man's moral organization, a kind Providence has placed in the mind a never-sleeping guardian, which is analogous to the reflex action (342) of some of the nerves. This is the moral sense, a kind of conscience with which man is so endowed as to protect him from spiritual death, when the rational faculties are inactive, or temporarily resting from their labors. This monitor acts constantly, unless its voice be so repeatedly stifled by the perverted agency of the voluntary powers as to silence it by a moral suffocation.

371. In concluding our observations upon the general system of man, we cannot but notice, that no part labors for itself. The nerves carry the mandates of the will to the muscles, the muscles act upon the bones, and in the union of these individual acts the functions of life proceed. The teeth grind up food for the stomach; the stomach digests it for the whole body, and only participates in the benefits of the nutritive process, so far as its own demands require. So it should be in the social relation: no one should labor for himself only. Each should discharge the duties incumbent upon him, honestly and industriously, in the love of the neighbor, or of doing what is right. The poor and the rich, the wise and the simple, are as mutually dependent as are the nerves, the muscles, and the various organs, which constitute a man.

